INSTRUCTION MANUAL

EQUIPMENT
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EMPIRE*

NOISE AND FIELD INTENSITY METER

MODEL NF-105F

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Precision electrical and electronic instruments for measurement

THE SINGER COMPANY • METRICS DIVISION

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MODEL NF-105F

S/N 3366

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1. Model or Type
2. Serial Number
3. Description of trouble(2)
4. Test instruments used
5. Approximate date instrument was placed in operation
6. Approximate number of hours of use
7. Has maintenance action been previously requested?
8. Other comments

Upon receipt of this information our Service Department will send you service data or shipping instructions. Upon receipt of shipping instructions forward the instrument to the factory prepaid. If requested, an estimate of charges will be made before work begins.

(1) Contact Metrics Division, Bridgeport, Connecticut for *Commander**, *Empire**, *Panoramic**, and *Sensitive Research** instruments. Contact Metrics Division, Los Angeles, California for *Gertsch** instruments.

(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.

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SECTION 1

GENERAL INFORMATION

1-1. GENERAL.

1-2. This Instruction Manual describes the electrical and physical characteristics, applications, installation, and operation of the Model NF-105-F Noise and Field Intensity Meter. Accessories, required for special applications, although not supplied with the instrument, are also included.

CAUTION

Do not attempt to operate the equipment until thoroughly familiar with the procedures detailed in Section 3 (OPERATION). Incorrect operation may result in unit malfunction.

1-3. DESCRIPTION.

1-4. The Noise and Field Intensity Meter measures the intensity of electromagnetic energy in the radio frequency range between 14 KC and 1 GC. The instrument is used as an RF carrier field intensity meter and as an RF interference (noise) meter. When used as an RF carrier field intensity meter, the instrument measures the RF carrier strength of narrow band amplitude modulated (AM), frequency modulated (FM), single sideband (SSB), and unmodulated (CW) signals. When used as an RF interference meter, the instrument measures the spectral intensity of broadband impulse noise.

1-5. A pickup device couples the test signal to the instruments input terminals. The instrument then acts as a tunable VTVM, measuring the strength of the input test signal at the selected frequency. Depending upon the parameters of the measurement, various accessories, including antennas, line probes, field probes, calibrated cables, and couplers, are employed as pickup devices.

1-6. The instrument consists of a basic measuring unit and five tuning units. The basic unit displays the strength of the RF tuned to by the tuning unit.

1-7. The basic unit controls the amplitude of the RF signal supplied to the tuning unit, detects the IF output of the tuning unit, and conditions the signal for display on the front panel meter. The unit also supplies an IF output, video output, and outputs for remote meter indication, X-Y plotting, and aural monitoring. The IF and video outputs are of low impedance used for panoramic or oscilloscope display, or for permanent spectrum recording. The basic unit includes an impulse generator used as a calibrating source for noise measurements, and a

transistorized power supply which provides all operating and heater voltages for the overall instrument.

1-8. Each of the five tuning units covers a portion of the instruments total frequency range. The units contain a tuned RF amplifier, IF conversion section, and IF amplifier. All units are supplied with heater voltage during instrument operation. No warmup delays are encountered when units are switched in order to scan the entire frequency spectrum.

1-9. Combining the basic unit with five tuning units facilitates rapid scanning of the instruments entire frequency spectrum. An optional antenna switching unit is used to switch any of five pickup antennas to the instruments input terminals, thus, decreasing downtime due to antenna interconnecting.

1-10. The instrument is designed for permanent installation, but also may be used as a field instrument. The basic measuring unit and tuning units are enclosed in a shielded dust cover and cooled by a forced air blower. The instrument may be used without further enclosure, mounted in an optional 19 inch cabinet rack, or installed in a standard 19 inch relay rack, without impairing shielding effectiveness.

1-11. APPLICATIONS.

1-12. The Noise and Field Intensity Meter is used for the following applications:

(a) Determining the usefulness of a site for RF transmission and reception.

(b) Studying communication conditions at a given site, by recording atmospheric noise versus time.

(c) Studying fading effects of RF signals, by recording signal strength versus time.

(d) Determining the area of useful transmitter coverage.

(e) Analyzing antenna radiation patterns.

(f) Localizing the source of RF energy.

(g) Determining shielding effectiveness.

(h) Determining the effectiveness of RF suppression measures on sources of RF interference.

(i) Measuring the strength of RF interference voltage present in electrical interconnecting, control, and power distribution leads.

(j) Determining the polarization of a radiated wave.

(k) Measuring the electric (E) and magnetic (H) field components of a radiated wave.

(l) Evaluating interference interaction of electronic components and systems.

(m) Determining the effects of electromagnetic environment upon electronic equipment, in terms of degradation and failure as the intensity of the electronic environment becomes more severe.

(n) Monitoring radiation from electronic equipment by production quality control.

(o) Monitoring radiation from electronic equipment after maintenance.

(p) Measuring the power versus frequency distribution of a transmitter output. (A transmitter output emission spectrum includes the fundamental frequency and associated modulation sidebands, as well as harmonic and non-harmonic spurious emissions and their associated sidebands. Spurious emissions include harmonics, parasitic emissions, and intermodulation products.)

(q) Measuring the RF carrier frequency stability of a transmitter output.

(r) Measuring spurious radiation.

(s) Measuring ambient RF interference.

(t) Measuring receiver local oscillator radiation.

(u) Analyzing bandpass, band rejection, and discriminating characteristics of electronic components, circuitry, and systems.

(v) Analyzing reflection and absorption characteristics of materials surrounding a source of electromagnetic energy.

(w) Tuning electronic circuits, by using the instrument as a tunable high sensitivity null detector.

(x) Analyzing frequency response of electronic circuitry, such as pre-emphasis and de-emphasis networks.

1-13. When used with the appropriate input transducer, pickup device, or input signal conditioner, the instrument also may be used for noise and field intensity measurements in the following fields: acoustics, vibration, geophysics, medical electronics, sonics, ultrasonics, telephony, telegraphy, and telemetry.

1-14. These applications utilize the instrument as an RF interference (noise) meter and as an RF carrier field intensity meter for making conducted, radiated, and inductive measurements of narrow band and broadband RF electromagnetic energy. For the purpose of explaining applications, and operating procedures, measurements are classed in the following four g eneral categories:

(a) Noise Intensity
(b) Noise Field Intensity
(c) Carrier Intensity
(d) Carrier Field Intensity

1-15. A different unit of measurement is used for each category. They are: voltage per unit bandwidth, voltage per unit bandwidth per meter, voltage, and voltage per meter, respectively. The categories are explained in terms of the normal application for each unit of measurement. Categories (a) and (b) are broadband measurements, and (c) and (d) are narrow band measurements. Since noise is usually braodband, and communication signals are usually narrow band, the categories are considered either noise or carrier measurments. For all measurements, the user must determine the components constituting signal and those of noise.

1-16. NOISE INTENSITY MEASUREMENTS. The instrument measures the intensity of braodband signals in terms of voltage per unit bandwidth. Broadband signals are thoise having a wide spectrum composed of many component waveforms. The waveforms usually have no communication intelligence content and therefore are considered noise.

1-17. Noise intensity measurements are expressed in the following units:

(a) Microvolts per megacycle of bandwidth (uv/MC).
(b) Microvolts per kilocycle of bandwidth (uv/KC).
(c) Decibels above one microvolt per megacycle of bandwidth (DBMC) across a 50 ohm source impedance.

1-18. Noise intensity measurements are made using the conducted, radiated, or inductive method of coupling.

1-19. NOISE FIELD INTENSITY MEASUREMENTS. The instrument measures the field intensity of broadband signals in terms of voltage per unit bandwidth per meter. Noise field intensity measurements differ from noise intensity measurements in that the radiated method of coupling only is used, and the effective height of the coupling antenna is taken into account. The unit of measurement is either uv/MC/meter, uv/KC/meter, or DBMC/meter.

1-20. CARRIER INTENSITY MEASUREMENTS. The instrument measures the intensity of narrow band signals in terms of voltage. Narrow band signals are sharply tunable, having a spectrum that is less than the bandpass of the circuitry

or unit receiving the signal. The signal usually consists of a carrier and its necessary modulation sidebands. Therefore, narrow band measurements are more applicable for carrier signals than noise, although noise may also be generated as a sharply tunable, narrow spectrum.

1-21. Carrier intensity measurements are made using the conducted method of coupling, and the measurement is expressed in microvolts or decibels above one microvolt.

1-22. CARRIER FIELD INTENSITY MEASURMENTS. The instrument measures the field intensity of narrow band signals in terms of voltage per meter. Carrier field intensity measurements differ from carrier intensity measurements in that the radiated method of coupling is used, and the effective height of the coupling antenna is taken into account. The unit of measurement is either microvolts per meter or decibels above one microvolt per meter.

1-23. METHODS OF MEASUREMENT. Coupling the electromagnetic energy to the instrument is accomplished by the conducted, radiated, or inductive method of coupling. The conducted method is employed for noise intensity and carrier intensity measurements, the radiated method for noise intensity, noise field intensity, and carrier field intesnity, and the inductive method for noise intensity.

1-24. Conducted. Conducted measurements are defined below. Definition (a) is intended more for carrier intensity measurements, than for noise intensity; definition (b), more for noise intensity than for carrier intensity.

(a) Measurement of electromagnetic energy present at the antenna terminals of equipment designed for the transmission of RF energy.

(b) Measurement of electromagnetic energy present in any external lead or material connected to a test sample. The lead may be the test samples interconnecting, control, or power lead, transmission line, or antenna; the material may be the test samples chassis, case, or shielding.

1-25. Conducted measurements are accomplished by coupling the RF energy present in the conductor to the input terminals of the instrument. Line probes, calibrated cables; and clamp-on couplers are used as coupler pickup devices. The instrument then acts as a two terminal VTVM, measuring the strength of the input test signal at the selected frequency.

1-26. Radiated. Radiated measurements are defined below. Definition (a) is intended more for carrier field intensity measurements, (b) for noise intensity and noise field intensity, (c) for ambient noise and/or carrier field intensity measurements.

(a) Measurement of electromagnetic energy emanated from the antenna of equipment designed for the transmission of RF energy. (This differs

from conducted measurements, in that antenna and transmission line effects are included.)

(b) Measurement of electromagnetic energy emanated from any external lead or material connected to a test sample. The lead may be the test samples interconnecting, control, or power lead, transmission line, or antenna; the material may be the test samples chassis, case or shielding.

(c) Measurement of electromagnetic energy existing in the vicinity of the instruments pickup device.

1-27. Radiated measurements are accomplished by coupling the RF energy existing in a radiated electromagnetic field to the input terminals of the instrument. Vertical, dipole, and loop antennas are used as the pickup devices for transforming the radiated energy into a voltage. The voltage is then measured by the instrument, acting as a tunable, two terminal VTVM.

1-28. Inductive. Inductive measurements are defined as: the measurement of the electric field or magnetic field component present in electromagnetic energy. The measurements localize the source of RF energy, determine the polarization of a radiated wave, and indicate relative changes in noise interference produced by noise suppression efforts.

1-29. Inductive measurements are accomplished by inductively coupling the electric field or magnetic field component of the RF energy, existing in an electromagnetic field, to the input terminals of the instrument. Electric field or magnetic field probes are used as pickup devices, depending upon the field component measured. The field probe pickup device transforms the electric field or magnetic field component of the energy present in the radiated field into a voltage. The voltage is then measured by the instrument, acting as a tunable, two terminal VTVM. This measurement is qualitative when moving the probe, searching for the source of RF energy. The measurement becomes quantitative, when the probe is permanently placed with respect to the test sample.

1-30. EQUIPMENT SUPPLIED.

1-31. Table 1-1 lists the equipment normally supplied with the Model NF-105-F Noise and Field Intensity Meter.

TABLE 1-1. EQUIPMENT SUPPLIED

ITEM	MODEL NUMBER
Basic Measuring Unit	BA-105-F
Tuning Unit 14 KC to 150 KC	T-X/NF-105-F
Tuning Unit 150 KC to 30 MC	T-A/NF-105-F
Tuning Unit 20 to 200 MC	T-1/NF-105-F

TABLE 1-1. EQUIPMENT SUPPLIED (cont'd)

ITEM	MODEL NUMBER
Tuning Unit 200 to 400 MC	T-2/NF-105-F
Tuning Unit 400 to 1000 MC	T-3/NF-105-F
Antenna Switching Unit	AS-105-F
Blank Tuning Unit Panel	BP-105-F
Cabinet Rack	CR-105-F

NOTE

Refer to paragraph 1-32 for additional information concerning the equipment supplied.

1-32. The following is applicable to the equipment supplied:

(a) The basic measuring unit must be used in conjunction with at least one tuning unit.

(b) For X-Y provision, the suffix "X" is added to the tuning unit model number.

(c) The antenna switching unit is an optional feature, used for switching one of five different antennas to the instruments input terminals. The unit serves as a convenience when measurements must be made in a hurry and delays due to cable interchanging must be avoided.

(d) Blank tuning unit panels should be used when any of the tuning units are removed from the basic measuring unit. Removal of tuning units impairs the instruments shielding effectiveness.

(e) The cabinet rack is an optional feature. The instrument may be used, without the cabinet rack, without impairing shielding effectiveness.

1-33. . EQUIPMENT SUPPLIED CHARACTERISTICS. Table 1-2 lists the electrical and physical characteristics and specifications of the equipment supplied.

TABLE 1-2. EQUIPMENT SUPPLIED CHARACTERISTICS

Dimensions:	
Without Cabinet	31-1/2" high x 19" wide x 17-13/16" deep.
With Cabinet	34-1/16" high x 21-9/16" wide x 18-1/2" deep
Weight:	
Complete Unit Without Cabinet	Approximately 160 lbs.
Power Requirements:	
AC	115 (+15, -10) or 230 (+30, -20) VAC, 50 to 400 cps, 250 watts.
DC (Optional)	12 (+3, -0.5) or 24 (+6, -1.0) VDC, 190 watts.

CAUTION

Before connecting the instrument to the input supply, refer to Section 2, Installation for information regarding input transformer switching and wiring changes.

Input Impedance:	50 ohms.
Input Attenuation:	0 to 80 DB in 20 DB steps by using the SIGNAL ATTENUATOR selector switch; 0 to 80 DB in 10 DB steps by using the SIGNAL ATTENUATOR selector switch in conjunction with the SUBTRACT 10 DB toggle switch; an additional 20 DB gain by using the -20 DB SIGNAL ATTENUATOR toggle switch when using the T-X/NF-105-F.
Frequency Range:	14 KC to 1 GC covered by five tuning units (See below).

TUNING UNIT	FREQUENCY RANGE	FREQUENCY BANDS	IF	NOMINAL NOISE BANDWIDTH	FULL SCALE SENSITIVITY
T-X	14 to 150 KC (3 Bands)	14 to 25 KC 25 to 62 KC 62 to 150 KC	225KC	2 KC	0.1 uv
T-A	150 KC to 30 MC (6 Bands)	150 to 360 KC 360 to 870 KC 870 to 2100KC 2.1 to 5.2 MC 5.2 to 12.7MC 12.7 to 30 MC	455KC 1.6MC 455KC 1.6MC 1.6MC 1.6MC	10 KC	1.0 uv
T-1	20 to 200 MC (2 Bands)	20 to 65 MC 65 to 200 MC	10.7MC	100 KC	10 uv
T-2	200 to 400 MC (1 Band)	200 to 400 MC	30 MC	200KC	10 uv
T-3	400 to 1000 MC	400 to 700 MC 700 to 1000 MC	42 MC	300KC	10 uv

Impulse Generator:

Pulse Repetition Rate	Approximately 70 cps
Pulse Spectrum Level	Flat to 1000 MC. 50 to 141 DB above 1 uv/MC bandwidth in 1 DB steps for tuning unit T-X/NF-105-F; 10 to 101 DB above 1 uv/MC bandwidth in 1 DB steps for all other tuning units.
Input Voltage Range	
Narrow Band	1 to 100,000 uv
Broadband	$\frac{1}{BW(MC)}$ uv/MC to $\frac{100,000}{BW(MC)}$ uv/MC
Outputs:	
IF	Low impedance output for panoramic display.
Video	Low impedance video information with bandwidth equal to one half if IF bandwidth.

X-Y (Optional) and Remote Meter	0 to 10 VDC varying as a function of frequency for X coordinate; the external meter output provides amplitude information used as the Y coordinate.

1-34. ACCESSORIES.

1-35. Table 1-3 lists the accessory items that are not furnished with the instrument, but are necessary for special applications. In the operating procedures that follow, it is assumed that such necessary accessories are available.

TABLE 1-3. ACCESSORIES

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
		KITS	
1	Standard Accessory Kit	KT-105-D	For most applications; consists of the following items (a) through (o), which may be ordered separately.
(a)	Accessory Kit Carrying Case	AC-105-C	Houses most often used accessories.
(b)	Tripod Bag	BG-105	
(c)	RF Cables (30 ft.) (2 each)	CB-105	For all measurements. NOTE Items (d), (e), and (f) must be used in conjunction with Antenna Masts MA-105 and Mast Socket MS-105-A.
(d)	Dipole Antenna Set	DM-105-T1	20 to 200 MC; directional; radiated.
(e)	Dipole Antenna Set	DM-105-T2	200 to 400 MC; directional; radiated.
(f)	Dipole Antenna Set	DM-105-T3	400 to 1,000 MC; directional; radiated.

TABLE 1-3. ACCESSORIES (cont.)

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
(g)	Earphones	EA-105	Monitor aural substitution PHONES output.
(h)	Electric Field Probe	EP-105-A	20 MC to 1000 MC; inductive; E field.
(i)	Grounding Strap	GR-105	
(j)	Line Probe (50 ohms)	LL-105	20 MC to 1000 MC; conducted.
(k)	Antenna Masts (3 each)	MA-105	Used in conjunction with Dipole Antenna Sets (d), (e), and (f).
(l)	Magnetic Field Probe	MP-105	20 MC to 1000 MC; inductive; H field.
(m)	Mast Socket	MS-105-A	Used in conjunction with Dipole Antenna Sets (d), (e), and (f).
(n)	Tuning Unit Carrying Case	TC-105	Houses spare tuning unit.
(o)	Tripod	TP-105-A	Supporting base for antennas.
2	Antenna Equipment for T-X/NF-105-F	LX-105	For applications using T-X/NF-105-F; consists of items (a) through (d); to operate this equipment, cables CB-105, Tripod TP-105-A, and Tripod Bag BG-105 (contained in Standard Accessory Kit KT-105-D) are required.
(a)	Line Probe (50 ohm)	LB-105	14 KC to 150 KC; conducted.
(b)	Loop Antenna (36inch diameter)	LG-105	14 KC to 150 KC; directional; radiated.

TABLE 1-3. ACCESSORIES (cont.)

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
(c)	Vertical Antenna (41 inch)	VX-105	14 KC to 150 KC; omnidirectional; radiated.
(d)	Antenna Equipment (T-X/NF-105-F) Carrying Case	XC-105	Houses LX-105 accessories.
3	Antenna Equipment for T-A/NF-105-F	LM-105	For applications using T-A/NF-105-F; consists of items (a) through (g); to operate this equipment, cables CB-105, Tripod TP-105-A, and Tripod Bag BG-105 (contained in Standard Accessory Kit KT-105-D) are required.
(a)	Line Probe (50 ohm)	LA-105	150 KC to 30 MC; conducted.
(b)	Antenna Equipment (T-A/NF-105-F) Carrying Case	LC-105	Houses LM-105 accessories.
(c)	Line Probe (500 ohms)	LF-105	150 KC to 30 MC; conducted.
(d)	Magnetic Probe	LO-105	150 KC to 30 MC; inductive; H field.
(e)	Loop Antenna (12 inch diameter)	LP-105	150 KC to 30 MC; directional; radiated.
(f)	Binding Post (High Impedance)	PA-105	Calibration of VA-105.
(g)	Vertical Antenna (41 inch)	VA-105	150 KC to 30 MC; omnidirectional; radiated.
4	Antenna Equipment for T-A/NF-105-F	LM-105-SC	This equipment consists of items corresponding to Antenna Equipment LM-105.

TABLE 1-3. ACCESSORIES (cont.)

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
			The equipment also contains item (a) for measurement in accordance with Signal Corps specifications.
(a)	Vertical Antenna (9 ft.)	VA-105-SC	150 KC to 30 MC; omnidirectional; high sensitivity; radiated.
	INDIVIDUAL ITEMS		
5	Alignment Harness	AH-105	To gain access to adjustments during alignment.
6	Antenna Switching Unit	AS-105-F	Switches up to five antennas to instruments input terminals.
7	Attenuator, Voltage Range Extension	AT-60-40	40 DB, 2 watt pad.
8	Broad Band Antenna Set	BB-105	Consists of items (a) through (c); 20 MC to 1000 MC; broadband; radiated; high sensitivity; must be used in conjunction with unbalanced Injection Block UN-105.
(a)	Antenna Cone		
(b)	Antenna Plane		
(c)	Antenna Rods (2 ft.) (6 each)		
9	Blank Tuning Unit Panel	BP-105-F	Used in place of a removed tuning unit to protect shielding.
10	Cabinet Rack	CR-105-F	Encloses instrument and dust cover.
11	Clamp-On Probe	CP-105	14 KC to 30 MC; conducted; without direct connection.

TABLE 1-3. ACCESSORIES (cont.)

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
			NOTE Items 12 through 15 reject undesirable signals at the frequency to which the filter is tuned.
12	Rejection Filter	F-A/NF-105	150 KC to 30 MC tunable rejection filter.
13	Rejection Filter	F-1A/NF-105	20 MC to 65 MC tunable rejection filter.
14	Rejection Filter	F-1B/NF-105	65 MC to 200 MC tunable rejection filter.
15	Rejection Filter	F-2/NF-105	200 MC to 400 MC tunable rejection filter.
16	Loop Antenna (36 inch diameter)	LG-105A	Remote model of Loop Antenna LG-105.
17	Line Probe (500 ohm)	LG-105	20 MC to 1000 MC; conducted
18	Loop Antenna (36 inch diameter)	LP-3-105	150 KC to 12 MC; remote; directional; high sensitivity; radiated.
19	Additional Equipment Carrying Case	OC-105	Houses Broad Band Antenna Set BB-105, DC Inverter M012-105 or M024-105, Remote Meter RE-105-AX, and cables.
20	Corner Reflector Antenna	RA-105	Consists of items (a) through (c); 400 MC to 1000 MC; directional; high sensitivity; radiated.
(a)	Carrying Case		
(b)	Corner Reflector (Collapsible)		

TABLE 1-3. ACCESSORIES (cont.)

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
(c)	Dipole Antenna		
21	Remote Indicator Cable (25 ft.)	RC-105X	Used with Remote Indicator RE-105-AX.
22	Remote Indicator	RE-105-AX	Contains a meter duplicating the main instrument meter, and provides a jack for aural monitoring.
23	Single Stab Tuner	ST-31-A	400 MC to 1000 MC tunable rejection filter.
24	Switching Unit	SU-105	Switches either of two inputs to output.
25	Tripod (Ruggedized)	TP-105-R	Ruggedized model of TP-105.
26	Vertical Antenna (41 inch)	VR-1-105	14 KC to 150 KC; remote; omnidirectional; radiated; consists of Antenna Whip Base VR-105, and 41 inch collapsible rod.
27	Vertical Antenna (9 ft.)	VR-3-105	14KC to 150KC; remote; omnidirectional; high sensitivity; radiated; consists of Antenna Whip Base VR-105, a ground ring for mounting to Broad Band Antenna Plane BB-105, and an adapter for use with the Broad Band Antenna Rods BB-105.
28	Unbalanced Injection Block	UN-105	Used in conjunction with Broad Band Antenna Set BB-105.
29	AC Power Cord		Connect instrument to AC power source.
30	Allen Wrenches (6 each)		Alignment and adjustment.

TABLE 1-3. ACCESSORIES (cont.)

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
31	Megacycle Ruler (Steel Tape)		20 MC to 400 MC; to adjust length of dipole antennas.
32	Megacycle Ruler (Engraved Bakelite)		400 MC to 1000 MC; to adjust length of dipole antennas.
33	RF Cable		Connects antenna switching unit output to basic unit input.

1-36. TUBE, TRANSISTOR, AND CRYSTAL COMPLEMENT.

1-37. Table 1-4 provides a correlation between circuit reference designator, type and function of all tubes, transistors, and crystals used in the instrument.

TABLE 1-4. TUBE, TRANSISTOR AND CRYSTAL COMPLEMENT

REF DESIG	TYPE	FUNCTION
BASIC UNIT		
V201	6BJ7	Triple Diode T3 Detector (Meter, Video and Audio)
V202	6BJ7	Triple Diode T2 Detector (Meter, Video and Audio)
V203	6BJ7	Triple Diode T1 Detector (Meter, Video and Audio)
V204	6BJ7	Triple Diode TA Detector (Meter, Video and Audio)
V205	6BJ7	Triple Diode TX Detector (Meter, Video and Audio)
V206A	12AT7	First Audio Amplifier
V206B		Video Output Cathode Follower
V207	6AS5	Second Audio Amplifier

TABLE 1-4. TUBE, TRANSISTOR AND CRYSTAL COMPLEMENT (cont.)

REF DESIG	TYPE	FUNCTION
V208	6DJ8	Meter Pulse Stretcher
V209A	12AU7	Impulse Generator Oscillator
V209B		Impulse Generator Amplifier
	TX TUNING UNIT	
V901	6BA6	RF Amplifier
V902	6C4	RF Local Oscillator
V903	6BJ6	First IF Amplifier
V904	6BJ6	Second IF Amplifier
V905	6BJ6	Third IF Amplifier
V906	6BJ6	Fourth IF Amplifier
V909	6C4	Beat Frequency Oscillator
	TA TUNING UNIT	
V700	5702	RF Amplifier
V701	5784	RF Mixer
V702	5702	RF Local Oscillator
V703	6BJ6	First 455 KC IF Amplifier
V704	6BJ6	Second 455 KC IF Amplifier
V705	6BJ6	Third 455 KC IF Amplifier
V706	6BJ6	Fourth 455 KC IF Amplifier
V707	6BJ6	First 1.6 MC IF Amplifier

TABLE 1-4. TUBE, TRANSISTOR AND CRYSTAL COMPLEMENT (cont.)

REF DESIG	TYPE	FUNCTION
V708	6BJ6	Second 1.6 MC IF Amplifier
V709	6BJ6	Third 1.6 MC IF Amplifier
V710	6BJ6	Fourth 1.6 MC IF Amplifier
T1 TUNING UNIT		
V8	6AK5	First RF Amplifier (20 to 65 MC)
V9	6AK5	Second RF Amplifier (20 to 65 MC)
V10A	12AT7	RF Mixer (20 to 65 MC)
V10B		RF Local Oscillator (20 to 65 MC)
V11	6AK5	First RF Amplifier (65 to 200 MC)
V12	6AK5	Second RF Amplifier (65 to 200 MC)
V13A	6U8	RF Mixer (65 to 200 MC)
V13B		RF Local Oscillator (65 to 200 MC)
V14	6AK5	First IF Amplifier
V15	6BJ6	Second IF Amplifier
V16	6BJ6	Third IF Amplifier
V17	6BJ6	IF Output Cathode Follower
T2 TUNING UNIT		
V1	5876	RF Amplifier
V2	6F4	RF Local Oscillator
V3	6BJ6	First IF Amplifier

TABLE 1-4. TUBE, TRANSISTOR AND CRYSTAL COMPLEMENT (cont.)

REF DESIG	TYPE	FUNCTION
V4	6BJ6	Second IF Amplifier
V5	6BJ6	Third IF Amplifier
V6	6BJ6	Fourth IF Amplifier
V7	6BJ6	IF Output Cathode Follower
X1	IN21C	RF Crystal Mixer
T3 TUNING UNIT		
V601	5876	RF Amplifier (700 to 1000 MC)
V602	6F4	RF Local Oscillator (700 to 1000 MC)
V603	5876	RF Amplifier (400 to 700 MC)
V604	6T4	RF Local Oscillator (400 to 700 MC)
V605A	6BQ7	First IF Amplifier (Cascode Coupled)
V605B		First IF Amplifier (Cascode Coupled)
V606	6AK5	Second IF Amplifier
V607	6AK5	Third IF Amplifier
V608	6AK5	Fourth IF Amplifier
V609	6BJ6	Fifth IF Amplifier
V610	6BJ6	IF Output Cathode Follower
X601	IN21C	RF Mixer (700 to 1000 MC)
X602	IN21C	RF Mixer (400 to 700 MC)

TABLE 1-4. TUBE, TRANSISTOR AND CRYSTAL COMPLEMENT (cont.)

REF DESIG	TYPE	FUNCTION
	POWER SUPPLY	
V101A	6080	+150 VDC Regulator
V101B		+150 VDC Regulator
V102	6AK5	+150 VDC Control
V103	6AQ5	-150 VDC Regulator
V104	6AK5	-150 VDC Control
V105	5651	-150 VDC REFERENCE
V106	OA2	+450 VDC REFERENCE
V107	OA2	+450 VDC REFERENCE
Q101	2N277	+6 VDC Regulator
Q102	2N277	+6 VDC Regulator
Q103	2N277	+6 VDC Regulator
Q104	2N242	+6 VDC Control
Q105	2N1306	+6 VDC Reference
Q106	2N1306	+6 VDC Control

SECTION 2

INSTALLATION

2-1. GENERAL.

2-2. Section 2 describes installation procedures for the Model NF-105-F Noise and Field Intensity Meter. These include: initial internal and external inspections, selection of indoor and outdoor operating sites, inter and intra-connections, and installation checks and calibration.

2-3. The instrument has been thoroughly inspected and calibrated prior to shipment. Uncrating and handling of the unit requires only normal precautions applicable to test equipment of this type.

2-4. INITIAL INSPECTION.

2-5. EXTERNAL. After removing the instrument from the shipping box, carefully inspect the exterior of the instrument for any damage which may have been sustained during shipment. Rotate all controls and/or switches throughout their complete range of rotation, checking for freedom of operation and positive detent locking. Pull out PULL-TURN-PUSH selector switches, rotate to adjacent position, push-in, check for positive detent locking and repeat for all positions. Ensure all plug-in tuning units are well seated.

CAUTION

Turning the PULL-TURN-PUSH selector switches without first pulling foward may damage the attenuators. Use extreme caution when operating these switches.

2-6. INTERNAL. Remove the chassis from the dust cover by loosening all front panel fastening screws and pulling chassis away from the dust cover. Remove all plug-in tuning units from the basic unit by pulling forward. The equipment is shipped with all tubes, transistors, crystals, plug-in units, and modules already installed. Check all such, components and units for security in their sockets, and wiring for loose connections. After completion of the internal inspection, reinstall the tuning units, dust cover, and all fastening screws.

2-7. SELECTION OF SITES.

2-8. The site selected for interference measurements should be located such that the applicable antenna or probe pickup device reaches the interference source when connected through the 30 foot RF Cable CB-105. When using the equipment

for field measurements, the site chosen should be free from projections that might interfere with the field strength pattern. Refer to the test specification applicable to the specific measurement, for details concerning the locating of the instrument with respect to the equipment under test.

2-9. INDOORS. Indoor measurements should be made in a shielded room. Interference not associated with the test sample will affect the accuracy of the measurement. When measuring in a shielded room, the ground plane should be bonded to the screened wall. Such insulation precautions increase the measurement accuracy. Personnel present should be limited to a minimum. No one should be closer than 3 feet from the test sample or pickup antenna.

2-10. OUTDOORS. Some radiated measurements are made outdoors and at a location remote from the test sample. While atmospheric noise will inevitably be present to some extent, other ambient noises should be eliminated as much as possible. This is accomplished by selecting a site (preferably on a hill or over water) that is open and level. Reception over water is normally more noise-free than over land. The selected site should have a minimum of trees and underbursh , and be at least 100 feet from any possible source of man-made interference (power lines, telephone lines, industrial buildings, etc.). Undesirable results may be expected if the instrument is operated under, or close to, steel bridges, underpasses, metal fences, iron-frame buildings, or any other projection displaying conductive or inductive properties.

2-11. INSTALLATION PROCEDURES.

2-12. MOUNTING. The instrument is enclosed in a dust cover. It may be used as is, mounted in the optional cabinet rack CR-105-F, or mounted in a 19 inch standard relay rack. To mount in the cabinet or relay rack, slide the entire dust cover and instrument into the rack, and fasten all front panel holding screws.

2-13. INTRA-CONNECTIONS. Intra-connections (inside the instrument case) are made at the factory and should not be changed unnecessarily. Upon installation and after the instrument has been used in a moving van, vessel, or aircraft, inspect the connectors, ensuring that none have become loose or broken.

2-14. INTER-CONNECTIONS. Inter-connections (outside the instrument case) are made during installation, as required by the specific application.

2-15. AC Power Cord. The AC power cord connects the basic unit POWER jack (AN connector) to the 115 VAC or 230 VAC input power source.

2-16. RF Cable CB-105. The two 30 foot RF Cables are taped together at fixed intervals, preventing shifting of their relative position. These cables are used for all measurements, since subsititution of cables of different type or length will change the measuring accuracy. The green RF cable connects the pickup device to the basic unit SIGNAL INPUT jack or to one of the antenna switching unit input jacks (TO ANT. 1 through TO ANT. 5). The red RF cable is used during

series calibration and connects the Unbalanced Injection Block UN-105 to the IMPULSE GEN. OUTPUT jack.

2-17. RF Cable RC-105X. When the Remote Indicator RE-105-AX is used, it is connected to the basic unit by means of this 25 foot cable. The cable is attached to the basic unit EXT. METER/RECORDER jack by means of an AN connector.

2-18. RF Patch Cords. When the antenna switching unit is used, an RF patch cord connects the TO SIGNAL INPUT jack on the antenna switching unit to the SIGNAL INPUT jack on the basic unit. Another RF patch cord is used when a Model NF-105 tuning unit is substituted in place of the Model NF-105-F tuning unit. The RF patch cord connects the TO ATTENUATOR jack on the Model NF-105 tuning unit to the corresponding push-out disc connector on the basic unit.

2-19. MODEL NF-105 TUNING UNIT SUBSTITUTION. The Model NF-105-F is adapted for use with Model NF-105 tuning units. Any or all of the five tuning units used with the Model NF-105 may be used in place of the corresponding Model NF-105-F tuning unit. Internal connections are made by plugging the pin-type board connector at the back of the Model NF-105 tuning unit to the corresponding Model NF-105-F basic unit receptacle. Each output from the input coaxial switch must be internally connected to the corresponding push-out connector.

2-20. An additional inter-connection is required. The Model NF-105 tuning unit TO ATTENUATOR jack is connected to the basic unit push-out connector by means of an RF patch cord. The basic unit push-out connectors are located inside the front panel adjacent to each tuning unit. These connectors are covered by a circular push-out disc on the front panel. The discs provide shielding during operation with the Model NF-105-F tuning units. They should not be pushed out if a Model NF-105 tuning unit is not to be used, and should be replaced when using the Model NF-105-F tuning unit.

2-21. 115 or 230 VAC OPERATION. The instrument is capable of operating from a 115 VAC or 230 VAC input supply. Toggle switch S102 selects the method of connecting the primary windings of input transformer T101. The toggle switch is located inside the dust cover, mounted on the power supply chassis. The primary windings are connected in parallel for 115 VAC operation and in series for 230 VAC operation.

CAUTION

Before connecting the instrument to the AC power source, remove the instrument chassis from its dust cover and check the position of S102. Ensure

it is positioned correctly for the applicable power source to be used. For 115 VAC operation, fuse F101 must be a 4 ampere slow blow type; for 230 VAC operation, a 2 ampere slow blow.

2-22. INSTALLATION CHECK.

2-23. To check the calibration of the instrument over its entire frequency spectrum, perform the calibration proceudres below.

CAUTION

Before performing the procedures below, refer to Section 3 (OPERATION) for nomenclature and function of controls. Incorrect positioning of controls may result in instrument malfunction.

2-24. INITIAL CONTROL SETTINGS. Before the equipment is turned on, set all controls to the following positions:

(a) POWER toggle switch ---------- OFF
(b) Input Function Selector Switch ---------- CALIBRATE

CAUTION

The SIGNAL ATTENUATOR selector switch (PULL-TURN-PUSH) must be pulled out before being turned. Turning without first pulling forward may damage the attenuator. Upon lining up the dot on the control with the desired position, push control all the way in.

(c) SIGNAL ATTENUATOR Selector Switch ------ 20 DB
(d) FREQUENCY RANGE Selector Switch on basic unit ---------- Applicable frequency range
(e) Frequency Controls on tuning units ---------- Applicable frequency
(f) IMPULSE GENERATOR DB above 1 uv/MC ---------- Both controls at maximum clockwise position

(g) SLIDEBACK Control ---------- Maximum clockwise
(h) GAIN Control ---------- Maximum clockwise
(i) VOLUME Control ---------- Maximum clockwise
(j) METER BALANCE Control ---------- Maximum clockwise
(k) ZERO ADJ Control ---------- Maximum clockwise
(l) Meter Function Selector Switch ---------- METER BALANCE
(m) SUBTRACT 10 DB toggle switch ---------- Normal off position
(n) BFO toggle switch onT-X/NF-105-F ---------- OFF
(o) SIGNAL ATTENUATOR toggle switch on T-X/NF-105-F ---------- NORMAL

2-25. METER ZERO. To adjust the meter for a zero indication, proceed as follows:

(a) Set instruments controls to positions listed in paragraph 2-24.

(b) Connect AC power cord between POWER receptacle on front of instrument and AC input source.

CAUTION

Refer to paragraph 2-21 before applying power. The 115 VAC/230 VAC toggle switch must be in the correct position for the applicable AC power source used.

(c) Set POWER toggle switch to ON and allow a 5 minute warmup.

(d) Adjust METER BALANCE control for zero indication on meter.

(e) Set Meter Function Selector Switch to ZERO ADJ.

(f) If meter indication is not zero, adjust ZERO ADJ control for a zero indication on meter.

(g) Set Meter Function Selector Switch to METER BALANCE.

(h) If meter indication is not zero, repeat steps (d) through (g) until no change from zero is noted.

2-26. INITIAL CALIBRATION. The following calibration is used to check the overall operability and accuracy of the instrument. Signal generators capable of supplying a CW signal (100 microvolts with a 50 ohm output impedance) at calibration frequencies from 14 KC to 1000 MC are required. (Signal Generators,

Models SG-8 through SG-10 supply these requirements from 50 KC to 1000 MC)[1]

2-27. The calibration is performed at the input terminals of the instrument, at a level of 100 microvolts CW, and at all the frequencies indicated in the calibration charts at the end of the manual. In the calibration charts, the number in DBMC indicated in the right hand column is that which is equivalent to 100 microvolts CW when the SIGNAL ATTENUATOR is in the 20 DB position. The GAIN control is adjusted to provide a full scale indication with a 100 microvolt CW input from the Signal Generator.

2-28. The Impulse Generator is then substituted for the CW signal from the Signal Generator, and the Impulse Generator level required to produce the same full scale indication is recorded. If the instrument is still in calibration, the recorded Impulse Generator level should correspond to the DBMC indicated in the calibration chart. The Meter Function Selector Switch must be in the CARRIER position when the Signal Generator CW signal is being monitored, and in the PEAK position when the Impulse Generator level is being recorded. To calibrate, proceed as follows:

(a) Connect applicable Signal Generator output through F Cable CB-105 (green cable) to the SIGNAL INPUT jack on the basic unit.

(b) Perform Meter Zero adjustment of paragraph 2-25.

(c) Turn on Signal Generator and allow a 5 minute warmup.

(d) Adjust output of Signal Generator for CW signal of 100 microvolts at applicable calibration chart frequency.

(e) Adjust FREQUENCY RANGE selector switch on basic unit to applicable frequency range.

(f) Adjust tuning unit frequency controls to desired frequency of calibration chart.

(g) Set Meter Function Selector Switch to CARRIER.

(h) Set Input Function Selector Switch to READ.

(i) Adjust GAIN control for full scale indication on meter.

(j) Set Meter Function Selector Switch to PEAK.

(k) Set Input Function Selector Switch to CALIBRATE.

[1] A Product of THE SINGER COMPANY, METRICS DIVISION.

(l) Without changing the INPUT ATTENUATOR selector switch or the GAIN control, adjust the IMPULSE GENERATOR DB above 1 uv/MC selector switches to obtain a full scale indication on the meter.

(m) The summation of the levels obtained in step (l) should correspond to the DBMC indicated in the calibration chart.

(n) If the same Signal Generator is to be used for other calibrations, set Impulse Generator DB above 1 uv/MC selector switches to maximum clockwise position, and perform steps (d) through (m).

(o) If another Signal Generator is to be used for calibration, turn Signal Generator off, set POWER toggle switch on basic unit to OFF, set Impulse Generator DB above 1 uv/MC selector switches to maximum clockwise position, and perform steps (a) through (n).

(p) If no other calibrations are to be performed, turn Signal Generator off, set POWER toggle switch on basic unit to OFF, and disconnect Signal Generator from basic unit.

2-29. SIGNAL ATTENUATOR CHECK. After the instrument is calibrated, the SIGNAL ATTENUATOR accuracy may be checked at any desired frequency by means of a calibrated step attenuator. Starting with a CW signal of 100 millivolts, the SIGNAL ATTENUATOR selector switch at 80 DB, and the GAIN control adjusted for full scale meter indication, insert 20 DB attenuation at a time by means of the calibrated step attenuator, and remove 20 DB at a time by means of the SIGNAL ATTENUATOR. The meter indication should remain at full scale The above is performed for all positions of the SIGNAL ATTENUATOR selector switch. The accuracy of each position of the SIGNAL ATTENUATOR is indicated by the difference in meter indications. To check the SIGNAL ATTENUATOR accuracy, proceed as follows:

(a) Connect applicable Signal Generator output to a calibrated step attenuator.

(b) Connect the step attenuator through RF Cable CB-105 (green cable) to the SIGNAL INPUT jack on the basic unit.

(c) Perform Meter Zero adjustment of paragraph 2-25.

(d) Turn on Signal Generator and allow a 5 minute warmup.

(e) Adjust output of Signal Generator for CW signal of 100 millivolts at desired frequency.

(f) Set step attenuator to 0 DB.

(g) Adjust FREQUENCY RANGE selector switch on basic unit to applicable frequency range.

(h) Adjust tuning unit frequency controls to desired frequency.

(i) Set SIGNAL ATTENUATOR selector switch to 80 DB.

(j) Set Meter Function Selector Switch to CARRIER.

(k) Set Input Function Selector Switch to READ.

(l) Adjust GAIN control for full scale indication on meter.

(m) Insert 20 DB attenuation by means of calibrated step attenuator.

(n) Remove 20 DB attenuation by setting SIGNAL ATTENUATOR selector switch to 60 DB.

(o) Meter should indicate full scale ± 1 DB.

(p) Repeat steps (l) through (o), inserting 20 DB attenuation by means of the calibrated step attenuator and removing 20 DB attenuation by means of the SIGNAL ATTENUATOR selector switch, for all positions of the SIGNAL ATTENUATOR.

(q) If the same Signal Generator is to be used at a different frequency, perform steps (e) through (p).

(r) If another Signal Generator is to be used for checking the SIGNAL ATTENUATOR accuracy, turn Signal Generator off, set POWER toggle switch to OFF, and perform steps (a) through (q).

(s) If no other accuracy checks are to be performed, turn Signal Generator off, set POWER toggle switch on basic unit to OFF, and disconnect Signal Generator and calibrated step attenuator from basic unit.

SECTION 3

OPERATION

3-1. GENERAL.

3-2. Section 3 provides a description of all front panel controls, indicators, and connectors, and describes the instruments operating procedures. Calibration, antenna factor, and conversion charts are provided at the end of this section.

3-3. OPERATING CONTROLS, INDICATORS, AND CONNECTORS.

3-4. Figure 3-1 locates all front panel operating controls, indicators, and connectors. The index numbers of Figure 3-1 are included in Table 3-1 which lists all control, indicator, and connector nomenclature and function.

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS.

INDEX NO.	NOMENCLATURE	FUNCTION
1	CABINET RACK CR-105-F (Optional)	Provides further enclosure for instrument and dust cover.
2	Input Function Selector Switch	
	CALIBRATE	Feeds output of Impulse Generator to input SIGNAL ATTENUATOR for calibration purposes.
	READ	Feeds input signal connected to SIGNAL INPUT jack to input SIGNAL ATTENUATOR for measurement purposes; shuts Impulse Generator off.
	SERIES INJECTION	Feeds output of Impulse Generator to IMPULSE GEN. OUTPUT jack for series injection for use with vertical, loop, and broadband antennas; input signal (composed of the Impulse Generator output and the input RF signal) connected to SIGNAL INPUT jack to input SIGNAL ATTENUATOR for measurement purposes.
3	SIGNAL INPUT Jack	Connects to signal input from pickup device and feeds the signal to the input SIGNAL ATTENUATOR.

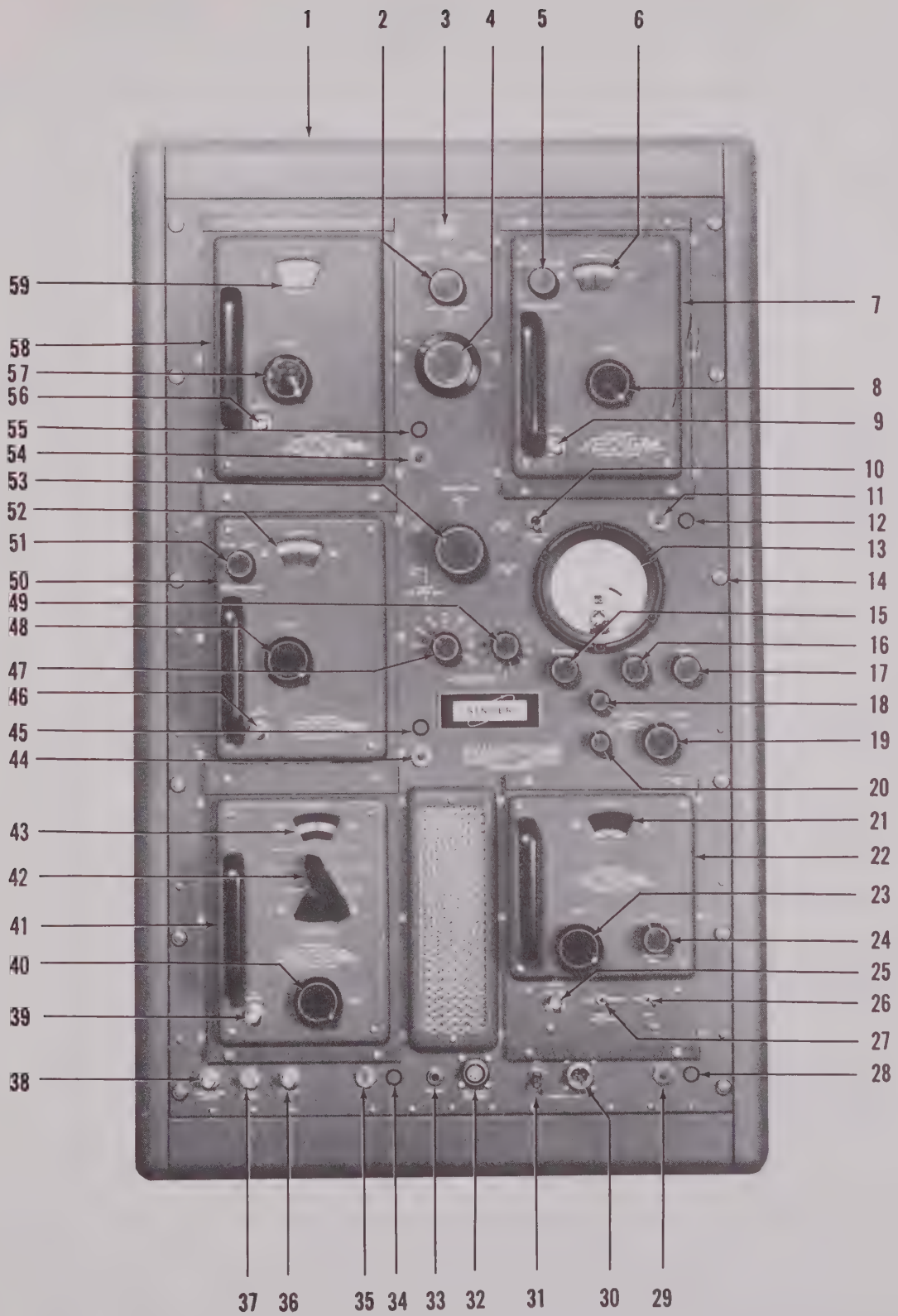


FIGURE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. (cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
4	SIGNAL ATTENUATOR (PULL-TURN-PUSH) Selector Switch	Selects 0, 20, 40, 60, or 80 DB attenuation of input signal. (When in the 0 DB position, read the meter orange scale; all other positions, read the meter black scale). CAUTION Turning the SIGNAL ATTENUATOR selector switch without first pulling forward may damage the attenuator. Use extreme caution when operating this selector switch.
5	FREQUENCY RANGE Selector Switch (T-3/NF-105-F)	Selects one of the following 2 bands: 400 - 700 700 - 1000
6	Frequency Indicator Dial (T-3/NF-105-F)	Indicates the frequency in MEGACYCLES that the unit is tuned to.
7	T-3/NF-105-F TUNING UNIT	Tunes-in and converts input RF (400 to 1000 MC in 2 bands) to IF
8	TUNING Control (T-3/NF-105-F)	Tunes unit to desired frequency.
9	I. F. OUTPUT Jack (T-3/NF-105-F)	Provides a pre-IF output of 42 MC.
10	SUBTRACT 10 DB Toggle Switch	Increases meter sensitivity by 10 DB. (Does not function when SIGNAL ATTENUATOR selector switch is in 0 DB position).
11	Indicator (T-3/NF-105-F)	Indicates T-3/NF-105-F tuning unit is in use.
12	Push-Out Disc (T-3/NF-105-F)	When pushed out, allows access to jack for externally connecting T-3/NF-105 tuning unit.

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. (cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
13	Meter Indicator	Indicates input signal or Impulse Generator level in microvolts or DB above 1 uv/MC; orange scale used when SIGNAL ATTENUATOR is positioned to 0 DB; black scale used for all other positions.
14	Basic Measuring Unit BA-105-F	Attenuates, detects, and displays the signal tuned to by the tuning unit.
15	SLIDEBACK Control	Adjusts biasing level of audio detector, reducing input RF signal or Impulse Generator calibrating signal to the threshold of audibility; provides clearer aural slideback reception with a high degree of discrimination between the signal to be measured and extraneous signals present. (Functions only when Meter Function Selector Switch is positioned to PEAK.)
16	GAIN Control	Adjusts the gain of each tuning unit IF stage; used to adjust meter indication to a reference for measurement and to full scale during calibration.
17	VOLUME Control	Adjusts the level of the audio output at the PHONES jack.
18	ZERO ADJ Control	Adjusts meter zero position before calibration and measurement.
19	Meter Function Selector Switch	
	METER BALANCE	Grounds the grids of meter differential amplifier so that METER BALANCE control can be used to balance meter differential amplifier.

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. (cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
	ZERO ADJ	Disables IF amplifiers so that ZERO ADJ control can be used to zero meter movement.
	CARRIER	Enables meter to indicate peak amplitude of unmodulated narrow band carriers or average value of modulated narrow band carriers.
	PEAK	Enables meter to indicate peak amplitude of broadband pulses or carriers.
20	METER BALANCE Control	Adjusts balance of meter differential amplifiers to compensate for differences in tubes 2 sections.
21	Frequency Indicator Dial (T-X/NF-105-F)	Indicates the frequency in KILOCYCLES that the unit is tuned to.
22	T-X/NF-105-F TUNING UNIT	Tunes-in and converts input RF (14 to 150 KC in 3 bands) to IF.
23	TUNING Control (T-X/NF-105-F)	Tunes to desired frequency.
24	FREQUENCY RANGE Selector Switch (T-X/NF-105-F)	Selects one of the following 3 bands: 14 - 25 25 - 62 62 - 150
25	I.F. OUTPUT Jack (T-X/NF-105-F)	Provides a pre-IF output of 225 KC.
26	BFO ON/OFF Toggle Switch (T-X/NF-105-F)	Activates 225.5 KC Beat Frequency Oscillator for mixing with 225 KC IF to produce 500 cps tone at PHONES jack. This assists in finding and tuning-in unmodulated CW signals.

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. (cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
		CAUTION Position the BFO ON/OFF toggle switch to OFF when making measurements. The Beat Frequency Oscillator is used only to assist in tuning-in the input signal.
27	SIGNAL ATTENUATOR -20 DB/NORMAL Toggle Switch (T-X/NF-105-F)	Increases meter sensitivity by 20 DB when set to -20 DB.
28	Push-Out Disc (T-X/NF-105-F)	When pushed out, allows access to jack for externally connecting T-X/NF-105 tuning unit.
29	Indicator (T-X/NF-105-F)	Indicates T-X/NF-105-F tuning unit in use.
30	POWER AC Line Input Jack	Connects to 115 or 230 VAC line power source and feeds the AC input to the power supply circuits.
31	POWER ON/OFF Toggle Switch.	Controls on-off condition of instrument.
32	EXT. METER/RECORDER Output Jack	Provides output for external Remote Indicator RE-105-AX, or for X-Y plotting.
33	PHONES Output Jack	Provides output for aural monitoring.
34	Push-Out Disc (T-A/NF-105-F)	When pushed out, allows access to jack for externally connecting T-A/NF-105 tuning unit.
35	Indicator (T-A/NF-105-F)	Indicates T-A/NF-105-F tuning unit in use.

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. (cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
36	IF OUTPUT Jack	Provides a post IF output.
37	VIDEO OUTPUT Jack	Provide an output equal to one half the IF bandwidth.
38	IMPULSE GEN. OUTPUT Jack	Provides the Impulse Generator output signal when the Input Function Selector switch is positioned to SERIES INJECTION.
39	I. F. OUTPUT Jack (T-A/NF-105-F)	Provides a pre-IF output of 455 KC for the .15-.36 and .87-2.1 MC ranges; 1.6 MC pre-IF for all other ranges.
40	TUNING Control (T-A/NF-105-F)	Tunes to desired frequency.
41	T-A/NF-105-F TUNING UNIT	Tunes-in and converts input RF (.36 to 30 MC in 6 bands) to IF.
42	FREQUENCY RANGE Selector Switch (T-A/NF-105-F)	Selects one of the following 6 bands: .15-.36 .36-.87 .87-2.1 2.1-5.2 5.2-12.7 12.7-30
43	Frequency Indicator Dial (T-A/NF-105-F)	Indicates the frequency in MEGACYCLES that the unit is tuned to.
44	Indicator (T-1/NF-105-F)	Indicates T-1/NF-105-F tuning unit in use.
45	Push-Out Disc (T-1/NF-105-F)	When pushed out, allows access to jack for externally connecting T-1/NF-105 tuning unit.
46	I. F. OUTPUT Jack	Provides a pre-IF output of 10.7 MC.

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. (cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
47	IMPULSE GENERATOR DB above 1 uv/MC 10 DB Steps Selector Switch	Selects Impulse Generator output level in 10 DB steps from 50 to 130 DB when using T-X/NF-105-F tuning unit; 10 to 90 DB for all other tuning units. (When using T-X/NF-105-F tuning unit, use outer scale; for all other tuning units, use inner scale.)
48	TUNING Control (T-1/NF-105-F)	Tunes to desired frequency.
49	INPULSE GENERATOR DB above 1 uv/MC 1 DB Steps Selector Switch	Selects Impulse Generator output level in 1 DB steps from 0 to 11 DB.
50	T-1/NF-105-F TUNING UNIT	Tunes-in and converts input RF (20 to 200 MC in 2 bands) to IF.
51	FREQUENCY RANGE Selector Switch (T-1/NF-105-F)	Selects one of the following 2 bands: 20-65 65-200
52	Frequency Indicator Dial (T-1/NF-105-F)	Indicates frequency in MEGACYCLES that the unit is tuned to.
53	FREQUENCY RANGE Selector Switch	Selects one of the fine tuning units for use. The position for each tuning unit is as follows: 14-150 KC for T-X/NF-105-F .15-30 MC for T-A/NF-105-F 20-200 MC for T-1/NF-105-F 200-400 MC for T-2/NF-105-F 400-1000 MC for T-3/NF-105-F
54	Indicator (T-2/NF-105-F)	Indicates T-2/NF-105-F tuning unit in use.

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. (cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
55	Push-Out Disc (T-2/ NF-105-F)	When pushed out, allows access to jack for externally connecting T-2/ NF-105 tuning unit.
56	I. F. OUTPUT Jack	Provides a pre-IF output of 30 MC.
57	TUNING Control (T-2/NF-105-F)	Tunes to desired frequency.
58	T-2/NF-105-F TUNING UNIT	Tunes-in and converts input RF (20 to 200 MC in one continuous band) to IF.
59	Frequency Indicator Dial (T-2/NF-105-F)	Indicates frequency in MEGACYCLES that the unit is tuned to.

3-5. APPLICATIONS AND METHODS OF MEASUREMENT.

3-6. The following paragraphs describe the applications and methods of measurement for the Model NF-105-F Noise and Field Intensity Meter. Accessories listed in Table 1-3 are required for special applications. Table 3-2 tabulates the applications and methods of measurement.

TABLE 3-2. APPLICATIONS AND METHODS OF MEASUREMENT

NOISE INTENSITY MEASUREMENTS				
APPLICATION	PEAK AMPLITUDE MEASUREMENT OF NEAR FIELD BROADBAND PULSE OR CARRIER SIGNALS			
METHOD OF MEASURING	DIRECT READING	SUBSTITUTION		
INDICATION	METER	AURAL (PHONES)	VISUAL (METER)	
UNITS OF MEASUREMENT	MICROVOLTS PER MEGACYCLE BANDWIDTH			
	MICROVOLTS PER KILOCYCLE BANDWIDTH			
	DB ABOVE 1 MICROVOLT PER MEGACYCLE BANDWIDTH (DBMC)			
PICKUP DEVICE	BROAD BAND ANTENNA	DIPOLE LOOP OR VERTICAL ANTENNA	LINE PROBE	ELECTRIC OR MAGNETIC FIELD PROBE
METHOD OF COUPLING	RADIATED	RADIATED	CONDUCTED	INDUCTIVE
COUPLING DEVICE	UNBALANCED INJECTION BLOCK	NONE	NONE	NONE
CALIBRATION	SERIES	SHUNT	SHUNT	SHUNT

NOISE FIELD INTENSITY MEASUREMENTS			
APPLICATION	PEAK AMPLITUDE MEASUREMENT OF FAR FIELD BROADBAND PULSE OR CARRIER SIGNALS		
METHOD OF MEASURING	DIRECT READING	SUBSTITUTION	
INDICATION	METER	AURAL (PHONES)	VISUAL (METER)
UNITS OF MEASUREMENT	MICROVOLTS PER MEGACYCLE BANDWIDTH PER METER		
	MICROVOLTS PER KILOCYCLE BANDWIDTH PER METER		
	DB ABOVE 1 MICROVOLT PER MEGACYCLE BANDWIDTH PER METER (DBMC/METER)		
PICKUP DEVICE	DIPOLE, LOOP, OR VERTICAL ANTENNA		
METHOD OF COUPLING	RADIATED		
COUPLING DEVICE	NONE		
CALIBRATION	SHUNT (SERIES FOR REMOTE ANTENNAS LG-105-A, VR-1-105, AND VR-3-105)		
CARRIER INTENSITY MEASUREMENTS			
APPLICATION	PEAK AMPLITUDE MEASUREMENT OF NEAR FIELD NARROW BAND UNMODULATED CARRIER SIGNALS OR AVERAGE AMPLITUDE MEASUREMENT OF NEAR FIELD NARROW BAND MOUDLATED CARRIER SIGNALS		

METHOD OF MEASURING	DIRECT READING
INDICATION	METER
UNITS OF MEASUREMENT	MICROVOLTS
	DB ABOVE 1 MICROVOLT
PICKUP DEVICE	ANY
METHOD OF COUPLING	ANY
COUPLING DEVICE	NONE
CALIBRATION	SHUNT
CARRIER FIELD INTENSITY MEASUREMENTS	
APPLICATION	PEAK AMPLITUDE MEASUREMENT OF FAR FIELD NARROW BAND UNMODULATED CARRIER SIGNALS OR AVERAGE AMPLITUDE MEASUREMENT OF FAR FIELD NARROW BAND MODULATED CARRIER SIGNALS
METHOD OF MEASURING	DIRECT READING
INDICATION	METER
UNITS OF MEASUREMENT	MICROVOLTS PER METER
	DB ABOVE 1 MICROVOLT PER METER
PICKUP DEVICE	DIPOLE, LOOP, OR VERTICAL ANTENNA
METHOD OF COUPLING	RADIATED

COUPLING DEVICE	NONE
CALIBRATION	SHUNT (SERIES FOR REMOTE ANTENNAS LG-105-A, VR-1-105, AND VR-3-105)

3-7. Measurements are classed in four general categories:

(a) NOISE INTENSITY
(b) NOISE FIELD INTENSITY
(c) CARRIER INTENSITY
(d) CARRIER FIELD

3-8. NOISE INTENSITY. For noise intensity measurements, the output of the internal Impulse Generator is directly compared to the level of the unknown signal. The indication may be direct reading (meter), visual substitution (meter), or aural slideback substitution (phones).

3-9. The slideback method offers two advantages over the other methods. It makes possible differentiation between two or more types of interference simultaneously present; also, it may be used at very low repetition rates (below 50 cycles), or for single impulses.

3-10. When employing the direct reading method, the internal Impulse Generator is used to calibrate the instrument. The instrument then becomes direct reading, measuring the input signal directly, in turns of voltage per unit bandwidth.

3-11. For most measurements, shunt calibration is employed. During shunt calibration, the calibrating voltage from the internal Impulse Generator is switched through the same input circuitry as the unknown voltage.

3-12. When the Broad Band Antenna Set, Remote Loop Antenna, or Remote Vertical Antenna is used as the pickup device, series calibration is employed. In this case, the calibrating voltage from the internal Impulse Generator is injected at the antenna in series with the unknown voltage.

3-13. For localizing the source of interference, the Electric or Magnetic Field Probe is used as the pickup device. The measurement is qualitative, only, when moving the probe, searching for the source of interference.

3-14. NOISE FIELD INTENSITY. Noise field intensity measurements are performed in the same manner as noise intensity measurements when using the dipole, loop, or vertical antenna. The effective height of the antenna is taken into account, and the measurement is expressed in terms of voltage per unit bandwidth per meter.

3-15. CARRIER INTENSITY. Carrier intensity measurements are performed in the same manner as noise intensity measurements when using the direct reading method of indication. After calibration, the instrument becomes direct reading, in terms of voltage.

3-16. CARRIER FIELD INTENSITY. Carrier field intensity measurements are performed in the same manner as noise field intensity measurements. The effective height of the antenna is taken into account, and the measurement is expressed in terms of voltage per meter.

3-17. PICKUP DEVICES. Table 3-3 lists the frequency range of all pickup devices.

TABLE 3-3. PICKUP DEVICE FREQUENCY RANGE

FREQUENCY RANGE	MODEL NO.	DESCRIPTION
14 KC to 150 KC	LB-105 LG-105 LG-105-A VR-1-105 VR-3-105 VX-105	Line Probe (50 ohm) Loop Antenna (36 inch diameter) Remote Model LG-105 Remote Vertical Antenna (41 inch) Remote Vertical Antenna (9 foot) Vertical Antenna (41 inch)
14 KC to 30 MC	CP-105	Clamp-On Probe
150 KC to 12 MC	LP-3-105	Remote Loop Antenna (36 inch diameter)
150 KC to 30 MC	LA-105 LF-105 LO-105 LP-105 VA-105 VA-105-SC	Line Probe (50 ohm) Line Probe (500 ohm) Magnetic Probe Loop Antenna (12 inch diameter) Vertical Antenna (41 inch) Vertical Antenna (9 foot)
20 MC to 200 MC	DM-105-T1	Dipole Antenna Set
20 MC to 1000 MC	BB-105 EP-105-A LH-105 LL-105 MP-105	Broad Band Antenna Set Electric Field Probe Line Probe (500 ohm) Line Probe (50 ohm) Magnetic Field Probe
200 MC to 400 MC	DM-105-T2	Dipole Antenna Set
400 MC to 1000 MC	DM-105-T3 RA-105	Dipole Antenna Set Corner Reflector Antenna

3-18. REJECTION FILTERS. Rejection filters are used when it is desired to measure weak signals in the presence of very strong undesirable signals. Each filter consists of a parallel tuned circuit which, when connected in series with input lead, rejects the signal at the frequency to which the filter is tuned. Several filters may be simultaneously used when a number of strong interfering signals are to be rejected. The frequency range of the filters are as follows:

F-A/NF-105	150 KC to 30 MC
F-1A/NF-105	20 MC to 65 MC
F-1B/NF-105	65 MC to 200 MC
F-2/NF-105	200 MC to 400 MC
Stub Tuner ST-31-A	400 MC to 1000 MC

3-19. PRELIMINARY PROCEDURES.

3-20. Before making any measurement, perform the following preliminary procedures as required:

(a) Determine the type of AC input line voltage. (Refer to paragraph 2-21.)

(b) Determine the category of the measurement. (Refer to paragraphs 1-14 through 1-22, paragraphs 3-5 through 3-16, and Table 3-2.)

(c) Determine the method of coupling and pickup device to be used. (Refer to paragraphs 1-23 through 1-29, Table 1-3, paragraphs 3-17 and 3-18, and Table 3-2.)

(d) Determine the method of measuring and indication. (Refer to Table 3-2.)

(e) Set all controls to their initial positions. (Refer to paragraph 2-24.)

(f) Perform Meter Zero Adjustment. (Refer to paragraph 2-25.)

(g) Perform Initial Calibration at frequency to be measured. (Refer to paragraphs 2-26 through 2-28.)

(h) Perform Signal Attenuator Check if a high degree of accuracy is required for the measurement. (Refer to paragraph 2-29.)

3-21. OPERATING PROCEDURES.

3-22. The following paragraphs describe operating procedures for the Model NF-105-F Noise and Field Intensity Meter and accessories. After the preliminary procedures have been performed, refer to the applicable operating procedure for measurements.

3-23. NOISE INTENSITY MEASUREMENTS. Noise intensity measurements are accomplished as follows.

3-24. Visual Substitution (Meter). Proceed as follows:

(a) Perform preliminary procedures as required.

(b) Connect the desired pickup device to the SIGNAL INPUT jack by means of the green 30 foot RF Cable CB-105.

(c) If the dipole antenna set or corner reflector antenna is to be used, adjust the dipole arms to the proper length for the frequency to be measured. Megacycle rulers are required for this adjustment. Placement of the antennas, relative to the source of RF noise, should be in accordance with the applicable specification or requirement.

(d) Position Input Function Selector Switch to READ.

(e) Position Meter Function Selector Switch to PEAK.

(f) Adjust the basic unit and applicable tuning unit frequency controls to the desired frequency.

(g) Adjust SIGNAL ATTENUATOR selector switch and GAIN control for a reference meter indication. Use as much signal input attenuation as is consistent with good signal to noise ratio.

(h) Position Input Function Selector Switch to CALIBRATE.

(i) Adjust IMPULSE GENERATOR DB ABOVE 1 uv/MC selector switches until the meter indication matches that obtained in step (g).

(j) The setting of the IMPULSE GENERATOR controls obtained in step (i) is the level of the unknown input signal in DBMC. To convert DBMC to microvolts per megacycle bandwidth or microvolts per kilocycle bandwidth, see Figures 3-2 and 3-3.

(k) If the level of the unknown signal fluctuates, the measurement should be made at the highest reading unless otherwise stipulated in the applicable specification.

(l) Since the insertion loss of the SIGNAL ATTENUATOR is the same for both unknown and calibrating signals, its reading need not be considered. If, however, the level of the unknown signal is higher than the maximum output of the impulse generator, it will be necessary to reduce the insertion loss of the SIGNAL ATTENUATOR when applying the calibrating signal. In this case, the change in SIGNAL ATTENUATOR setting in DB must be added to the IMPULSE GENERATOR reading. Conversely, if the level of the unknown signal is lower than the lowest output of the impulse generator, it will be necessary to increase the insertion loss

of the SIGNAL ATTENUATOR when applying the calibrating signal. In this latter case, the change in SIGNAL ATTENUATOR setting in DB must be subtracted from the IMPULSE GENERATOR reading.

(m) Since there is a slight signal attenuation in the 30 foot RF cable, it is necessary for full accuracy to add a correction factor for this cable loss. The correction factor is obtained from Figure 3-4.

(n) If the measurement was made with the dipole antenna, a mismatch occured; the theoretical 72 ohm impedance of the dipole was terminated in the 50 ohm input impedance of the instrument. In order to compensate for this mismatch, add 1.7 DB to the indicated reading. If, as required by some specifications, open circuit voltage (antenna induced voltage) is desired, an additional factor of 6 DB must be added.

(o) If another antenna was used, refer to the applicable antenna factor correction chart at the end of the manual. Add the value obtained from the chart to the IMPULSE GENERATOR setting obtained in step (i).

(p) When changing frequency ranges or switching between tuning units, recalibrate the new frequency by following the procedure outlined above.

3-25. Aural Slideback Substitution (Phones). Proceed as follows:

(a) Perform preliminary procedures as required.

(b) Connect the desired pickup device to the SIGNAL INPUT jack by means of the green 30 foot RF Cable CB-105.

(c) Connect Earphones EA-105 to PHONES output jack.

(d) Position Input Function Selector Switch to READ.

(e) Position Meter Function Selector Switch to PEAK.

(f) Adjust the basic unit and applicable tuning unit frequency controls to the desired frequency.

(g) Position SIGNAL ATTENUATOR selector switch to the highest insertion loss which still permits listening to the unknown noise.

(h) Adjust the GAIN control to about 60 or 70 percent of maximum clockwise position.

(i) Adjust SLIDEBACK control to the position at which the peaks of the unknown signal are barely audible in the earphones.

NOTE

Adjusting the GAIN control to near its minimum position may result in instrument overload, causing erroneous readings.

(j) An alternate method is to adjust the SLIDEBACK control to 50 percent of maximum clockwise position, and adjust GAIN control to maintain a barely audible level in the earphones.

NOTE

After adjusting the GAIN and SLIDEBACK controls until the noise is at the threshold of audibility, do not change the position of these controls until after the measurement.

(k) Position Input Function Selector Switch to CALIBRATE.

(l) Adjust IMPULSE GENERATOR DB ABOVE 1 uv/MC selector switches until the output supplied to the earphones is at the threshold of audibility as was the unknown signal.

(m) The setting of the IMPULSE GENERATOR controls in step (l) is the level of the unknown input signal in DBMC.

(n) For full accuracy, add the correction factor for cable losses obtained from Figure 3-4.

(o) If the measurement was made with the dipole antenna, the indicated signal level must be ocrrected for mismatch by adding 1.7 DB to obtain the dipole voltage. If open circuit voltage is desired, add an additional 6 DB.

(p) If the level of the unknown signal is higher than the maximum output of the impulse generator or lower than its minimum output, the measurement may be made by operating the SIGNAL ATTENUATOR as explained in paragraph 3-24, step (l).

3-26. Direct Reading (Meter). As an alternate method, the instrument is calibrated as a two terminal RF voltmeter. This is essentially the reverse of the substitution procedures describes in paragraphs 3-24 and 3-25. The instrument is calibrated prior to taking readings of the unknown voltage, and thus becomes direct reading in terms of voltage per unit bandwidth. Proceed as follows:

(a) Perform preliminary procedures as required.

(b) Connect the desired pickup device to the SIGNAL INPUT jack by means of the green 30 foot RF Cable CB-105.

(c) Position Input Function Selector Switch to CALIBRATE.

(d) Position Meter Function Selector Switch to PEAK.

(e) Adjust the basic unit and applicable tuning unit frequency controls to the desired frequency.

NOTE

For tuning units T-1/NF-105-F, T-2/NF-105-F, and T-3/NF-105-F, perform steps (f) through (o); for T-A/NF-105-F, steps (p) through (x); and for T-X/NF-105-F, step (y) through (ab).

(f) Position SIGNAL ATTENUATOR selector switch to 40 DB.

(g) Position IMPULSE GENERATOR controls to 80 DB. (Sum of positions of both selector switches.)

(h) Adjust GAIN control for full scale indication on meter.

(i) The instrument is now calibrated for a full scale sensitivity of 80 DB above 1 uv/MC. The sensitivity may be increased or decreased in 20 DB steps by changing the setting of the SIGNAL ATTENUATOR selector switch; increased in 10 DB steps by using the SUBTRACT 10 DB toggle switch.

(j) Full scale sensitivity for each setting of the SIGNAL ATTENUATOR selector switch are as follows:

SIGNAL ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	40 DBMC
20 DB	60 DBMC
40 DB	80 DBMC
60 DB	100 DBMC
80 DB	120 DBMC

(k) It must be noted that the sum if the readings in DB of the SIGNAL ATTENUATOR selector switch (40 DB) and of the meter (20 DB) add up to 60 DB which differs by 20 DB from the full scale sensitivity mentioned above. This difference is due to the fact that the bandwidth of the instrument is considerably less than one megacycle.

(l) Position Input Function Selector Switch to READ.

(m) The instrument now will measure the unknown input directly. The level of the unknown input is the sum of the SIGNAL ATTENUATOR selector switch setting minus 20 DB plus the meter reading. (For high accuracy measurements, add cable loss correction factor. See Figure 3-4.)

(n) When chnaging to a new frequency, the GAIN control may required re-adjustment in order to maintain full scale reading of the calibrating voltage.

NOTE

For measurements in the presence of a high noise background, it is recommended that the substitution method (Refer to paragraphs 3-24 and 3-25.) be used in preference to the direct reading method.

(o) The calibration procedure outlined above utilizes the full sensitivity of T-1/NF-105-F. However, the higher frequency heads T-2/NF-105-F and T-3/NF-105-F have wider bandwidths and therefore they are capable of more noise sensitivity. To fully realize this extra sensitivity, the instrument may be calibrated at a lower level of impulse generator voltage by using more IF gain. In this case, the indicated readings must be increased by a factor equal to the amount by which the sensitivity was increased. The sensitivity was increased. The sensitivity should not be increased beyond the point where the receiver noise level becomes excessive.

NOTE

Perform steps (p) through (x) for tuning unit T-A/NF-105-F.

(p) Position the SIGNAL ATTENUATOR selector switch to 20 DB.

(q) Position IMPULSE GENERATOR controls to DBMC value listed in applicable calibration chart for the desired frequency.

(r) Adjust GAIN control for full scale meter indication.

above. This difference is due to the fact that the bandwidth of the instrument is considerably less than one megacycle.

(d) The instrument may also measure the nonconductive liquid directly. The level of the nonconductive liquid in the sight glass is read directly on the [illegible] scale. (See Figure 4.)

(e) When changing to a new frequency, the [illegible] control may require readjustment in order to maintain full scale reading of the calibrating voltage.

(f) The calibrated pressure control knob utilizes the null principle of [illegible]. However, the meter [illegible] to a direct reading of pressure.

(g) [illegible]

(s) The instrument now has a full scale sensitivity of 100 microvolts as a two terminal RF VTVM. The sensitivity may be increased or decreased in 20 DB steps by changing the setting of the SIGNAL ATTENUATOR selector switch; increased in 10 DB steps by using the SUBTRACT 10 DB toggle switch.

(t) Full scale sensitivity for each setting of the SIGNAL ATTENUATOR selector switch are as follows:

SIGNAL ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	10 Microvolts
20 DB	100 Microvolts
40 DB	1,000 Microvolts
60 DB	10,000 Microvolts
80 DB	100,000 Microvolts

(u) Position Input Function Selector Switch to READ.

(v) The instrument now will measure the unknown signal directly. The level of the unknown input is the sum of the SIGNAL ATTENUATOR selector switch setting plus the meter reading. (For higher accuracy measurements, add cable loss correction factor. See Figure 3-4.)

(w) If sensitivity in excess of that produced by the above calibration is desired, the sensitivity may be increased by 20 DB by setting the SIGNAL ATTENUATOR selector switch to 40 DB instead of 20 DB as described in step (p). Full scale sensitivity is then as follows:

SIGNAL ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	1 Microvolt
20 DB	10 Microvolts
40 DB	100 Microvolts
60 DB	1, 000 Microvolts
80 DB	10, 000 Microvolts

(x) The level of the unknown input signal is now the SIGNAL ATTENUATOR selector switch setting, minus 20 DB, plus the meter reading, and correction factor.

NOTE

Perform steps (y) through (ab) for tuning unit T-X/NF-105-F.

(y) Perform steps (p) through (x).

(z) The sensitivity of step (w) is also attained by positioning the SIGNAL ATTENUATOR selector switch to 20 DB and the SIGNAL ATTENUATOR -20 DB/NORMAL toggle switch on tuning unit T-X/NF-105-F to -20 DB while calibrating.

(aa) If a 40 DB increase of sensitivity is desired during calibration, position the SIGNAL ATTENUATOR selector switch to 40 DB and the SIGNAL ATTENUATOR -20 DB/NORMAL toggle switch on tuning unit T-X/NF-105-F to -20 DB. Full scale sensitivity is then as follows:

SIGNAL ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	0.1 Microvolt
20 DB	1 Microvolt
40 DB	10 Microvolts
60 DB	100 Microvolts
80 DB	1,000 Microvolts

(ab) The level of the unknown input signal is now the SIGNAL ATTENUATOR selector switch setting, minus 40 DB, plus the meter reading, and correction factor.

3-27. Series Injection Measurements. As indicated in previous paragraphs, the shunt calibration method (calibration at input terminals of instrument) is applied when dipole, loop, or vertical antennas, or line probes are used as pickup devices. For Broad Band Antenna BB-105, Remote Vertical Antennas VR-1-105 and VR-3-105, or Remote Loop Antenna LP-105-A, series calibration (calibration signal in series with unknown) is used. An extra factor of 20 DB must be applied, since the Unbalance Injection Block UN-105 and base of the remote antennas attenuates the calibrating signal by this amount.

3-28. To use this method, connect both of the 30 foot RF cables CB-105 to the corresponding color coded receptacles on the remote antenna base or unbalanced injection block, the unbalanced injection block to the brood band antenna, the green RF cable to the SIGNAL INPUT jack, and the red RF cable to the IMPULSE GEN. OUTPUT jack.

3-29. Position the Input Function Selector Switch to READ. Position the Meter Function Selector Switch to PEAK. Tune to the desired frequency. Adjust SIGNAL ATTENUATOR and GAIN controls to produce a reference reading on the meter. Position the Input Function Selector Switch to CALIBRATE. Adjust the IMPULSE GENERATOR controls to obtain the reference reading. The unknown input signal is 20 DB less then the setting of the IMPULSE GENERATOR controls, due to the attenuation of the calibration voltage in the unbalanced injection block or remote antenna base. The value of the measurement is the open circuit voltage.

0 DB	0.1 Microvolt
20 DB	1 Microvolt
40 DB	10 Microvolts
60 DB	100 Microvolts
80 DB	1,000 Microvolts

3-30. For full accuracy, apply the cable loss correction factor. Note that the polarity of the cable loss correction factor depends upon the method of calibration. In the shunt calibration method, the instrument is calibrated to read voltage at its input terminals. The cable loss reduces the voltage between the signal source and the input terminals; therefore, the correction factor is positive. In the series calibration method, the calibrating voltage is injected at the pickup device. This voltage is attenuated by the 30 foot RF cable so that the unknown signal is greater than the indicated value. Therefore, the correction factor is negative.

3-31. In the calibration procedure outlined above, visual substitution (meter) indication was descirbed. Aural slideback substitution (phones) also may be used in a manner similar to that descirbed in paragraph 3-24. In addition, the instrument may be calibrated for direct reading, as outlined in paragraph 3-26.

3-32. NOISE FIELD INTENSITY MEASUREMENTS. When measurements are made in a shielded room at low frequencies, vertical antenna are usually used; at high frequencies, dipole antennas. Measurements are made in a similar manner as noise intensity measurements.

3-33. When using Vertical Antenna VA-105 in a shielded room, the base of the coupler must be mounted on a metal plate about 12 inches square (not furnished). The metal plate must be bonded to the metal bench top by means of a copper bond strap 12 inches wide.

3-34. Results obtained when using the loop antenna will be more accurate since they are essentially independent of ground consistency and height above ground. On the other hand a disadvantage of the loop antenna, especially at the lower frequencies, is its small effective height compared to that of the vertical antenna. For these reasons, use the loop antenna for field strength measurements whenever the signal level is sufficient to produce an adequate indication. Since the loop antenna is a directive device, it must be rotated for maximum pickup as indicated by the meter.

3-35. If a low signal level makes the use of the vertical antenna necessary, it is recommended that the antenna be located over the center of a network of wires placed on the ground and covering an area of approximately 800 square feet. The base of the antenna coupler must be connected to the ground network by a side bonding strap.

3-36. In spite of the precaution of spreading a ground wire network it is recommended that for greater accuracy, the vertical antenna be calibrated by means of the loop antenna at or near the frequency to be measured.

3-37. When making measurements with the dipole antenna, turn the antenna about a vertical axis until a maximum indication is accomplished. If the reading is either off scale or too low, change the setting of the SIGNAL ATTENUATOR until a reading is obtained within the central portion of the meter scale. The voltage picked up by

3-30. For full accuracy, apply the cable loss correction factor. Note that the polarity of the cable loss correction factor depends upon the method of calibration. In the shunt calibration method, the instrument is conducted to read voltage at its input terminals. The cable loss reduces the voltage between the signal source and the input terminals; the correction factor is positive. In the series calibration method, the calibrating voltage is injected at the pickup device. This voltage is attenuated by the 30 foot RF cable so that the unknown signal is greater than the indication value. Therefore, the correction factor is negative

3-31. In the calibration procedure outlined above, visual substitution (meter) indication was described. Aural sidetone substitution (phones) also may be used in a manner similar to that described in paragraph 3-27. In addition, the instrument may be calibrated for direct reading as outlined in paragraph 3-26.

3-32. [illegible] WHEN MEASUREMENTS ARE MADE. When measurements are made in a shielded room at low frequencies, vertical antennas are usually used; at high frequencies, dipole antennas. Measurements are made in a similar manner as noise [illegible]

3-33. When using V-ritical Antenna VA-105 in a shielded room, the base of the coupler must be mounted on a metal plate about 12 inches square (not furnished). The metal plate must be bonded to the metal box, top by means of a copper bond strap (1) as [illegible]

3-34. [illegible] When using the loop antenna will be more accurate since they are essentially independent of ground conductivity and height above ground. On the other hand a disadvantage of the loop antenna [illegible] at the lower frequencies, is its small effective [illegible] operation to that of the vertical antenna. For these reasons, use the loop antenna for [illegible] measurements whenever the signal [illegible] application is [illegible] to loop antenna is a [illegible] (1) [illegible] indicated by the meter.

3-35. In a location [illegible] necessary, it is [illegible] of the [illegible] of wires placed on the ground and covering an area of approximately 400 square feet. The base of the antenna coupler may be [illegible] covered by a suitable [illegible]

the dipole is of the maximum value when the axis of the dipole arms is perpendicular to the direction in which the signal source is located. The dipole should also be rotated about a horizontal axis to give maximum response. It may be turned to any angle from horizontal to vertical. For accurate measurements, it is desirable to take three different readings, with the dipole antenna moved to different locations which are not in a straight line. The average of the three readings should then be used as the significant measurement.

3-38. To obtain the field intensity level of the measured signal, the applicable antenna factors must be taken into account.

3-39. When using the dipole antenna, obtain the antenna correction factor from Figure 3-5. The reading obtained from the chart is the open circuit voltage. If loaded circuit voltage is desired, subtract 6 DB.

3-40. When using loop or vertical antennas, obtain the antenna correction factor from the applicable figure. To the reading obtained from the chart, add 6 DB for vertical antennas VA-105, VX-105, and VR-1-105, and subtract 3 DB for vertical antenna VR-3-105.

3-41. CARRIER INTENSITY MEASUREMENTS. The instrument is calibrated for direct reading with the impulse generator when making carrier intensity measurements. This is permissible since both the level of the impulse generator and the bandwidth of the tuning units are known. The bandwidth of the tuning unit is a consideration, since the impulse noise sensitivity of the tuning unit is a function of its bandwidth. Thus, if the tuning unit had a bandwidth of one megacycle, its CW sensitivity in microvolts would equal its impulse sensitivity expressed in microvolts per megacycle bandwidth. If the tuning unit bandwidth was only 100 kilocycles; the impulse noise calibrating voltage required for the previous CW sensitivity adjustment of the instrument would have to be increased by a factor of 10.

3-42. For carrier intensity measurements, proceed as follows:

(a) Perform preliminary procedures as required.

(b) Connect the desired pickup device to the SIGNAL INPUT jack by means of the green 30 foot RF Cable CB-105.

(c) Position Input Function Selector Switch to CALIBRATE.

(d) Position Meter Function Selector Switch to PEAK.

(e) Adjust the basic unit and applicable tuning unit frequency controls to the desired frequency.

(f) Position SIGNAL ATTENUATOR selector switch to 20 DB.

(g) Adjust GAIN control to approximately 75 percent of maximum clockwise position.

(h) Adjust IMPULSE GENERATOR DB ABOVE 1 uv/MC selector switches to DB level obtained from applicable calibration chart.

(i) Adjust GAIN control for full scale meter indication.

(j) The instrument is now calibrated for a full scale sensitivity of 100 microvolts or 40 DB. The sensitivity may be increased or decreased in 20 DB steps by changing the setting of the SIGNAL ATTENUATOR selector switch; increased by 10 DB by using the SUBTRACT 10 DB toggle switch; or increased by 20 DB by using the SIGNAL ATTENUATOR -20 DB/NORMAL toggle switch on the T-X/NF-105-F.

(k) Full scale sensitivity for each setting of the SIGNAL ATTENUATOR selector switch is as follows:

SIGNAL ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	10 Microvolts
20 DB	100 Microvolts
40 DB	1,000 Microvolts
60 DB	10,000 Microvolts
80 DB	100,000 Microvolts

(l) Position Input Function Selector Switch to READ.

(m) Position Meter Function Selector Switch to CARRIER for average measurement of CW signals; leave in PEAK position for peak measurement of modulated carriers.

(n) The instrument now will measure the unknown input directly. The level is the sum of the SIGNAL ATTENUATOR selector switch setting plus the meter reading. (For high accuracy measurements, add cable loss factor. See Figure 3-4.)

(o) Inasmuch as the accuracy of carrier measurements is somewhat affected by the slight bandwidth variations of the instrument for different frequencies, the bandwidth factors in DB are listed in the applicable coversion chart. These are added to the reading in DB above one microvolt if full accuracy is desired. To convert from "DB above one microvolt" to "microvolt" use the conversion chart. Figure 3-2.

3-43. In the presence of high ambient interference or high hiss level, an accurate carrier measurement may be performed in the following manner:

(a) Note the meter reading in microvolts produced by the combined noise and carrier levels.

(b) Detune the instrument sufficiently to lose the carrier signal.

(c) Note the reading of the noise alone.

(d) Apply the formula:

$$S = \sqrt{A^2 - N^2}$$

to determine the carier signal level. S is the unknown carrier signal level, A the combined noise and carrier level, and N the noise level (all in microvolts). For example, if the combined noise and signal level is 50 microvolts, and the noise level 30 microvolts, the true signal level would be:

$$S = \sqrt{50^2 - 30^2}$$
$$= 40 \text{ microvolts}$$

3-44. CARRIER FIELD INTENSITY MEASUREMENTS. Calibrate the instrument as for noise intensity measurements. Set up the antenna pickup devices as for carrier field intensity measurements. The measurement level is expressed in microvolts per meter or DB above 1 microvolt per meter. Use Figures 3-17 and 3-18 to convert the field strength to power density.

DB ABOVE 1 MICROVOLT
TO
MICROVOLTS

OR

DB ABOVE 1 MICROVOLT PER MEGACYCLE BANDWIDTH (DBMC)
TO
MICROVOLTS PER MEGACYCLE BANDWIDTH

Total DB OR DBMC	20	30	40	50	60	70	80	90
0	10.0	31.6	100	316	1000	3160	10000	31600
1	11.2	35.5	112	355	1120	3550	11200	35500
2	12.6	39.8	126	398	1260	3980	12600	39800
3	14.1	44.7	141	447	1410	4470	14100	44700
4	15.8	50.1	158	501	1580	5010	15800	50100
5	17.8	56.2	178	562	1780	5620	17800	56200
6	20.0	63.1	200	631	2000	6310	20000	63100
7	22.4	70.8	224	708	2240	7080	22400	70800
8	25.1	79.4	251	794	2510	7940	25100	79400
9	28.2	89.1	282	891	2820	8910	28200	89100
10	31.6	100.0	316	1000	3160	10000	31600	100000

MICROVOLTS

OR

MICROVOLTS PER MEGACYCLE BANDWIDTH

FIGURE 3-2 - CONVERSION CHART

DB ABOVE 1 MICROVOLT PER MEGACYCLE (DBMC)
TO
MICROVOLTS PER KILOCYCLE BANDWIDTH

TOTAL DBMC	20	30	40	50	60	70	80	90
0	.010	.031	.10	.31	1.0	3.1	10.0	31
1	.011	.035	.11	.35	1.1	3.5	11.0	35
2	.012	.040	.12	.40	1.2	4.0	12.0	40
3	.014	.044	.14	.44	1.4	4.4	12.0	44
4	.015	.050	.15	.50	1.5	5.0	15.0	50
5	.017	.056	.17	.56	1.7	5.6	17.0	56
6	.020	.063	.20	.63	2.0	6.3	20.0	63
7	.022	.070	.22	.70	2.2	7.0	22.0	70
8	.025	.079	.25	.79	2.5	7.9	25.0	79
9	.028	.089	.28	.89	2.8	8.9	28.0	89
10	.031	.100	.31	1.00	3.1	10.0	31.0	100

MICROVOLTS PER KILOCYCLE BANDWIDTH

FIGURE 3-3 - CONVERSION CHART

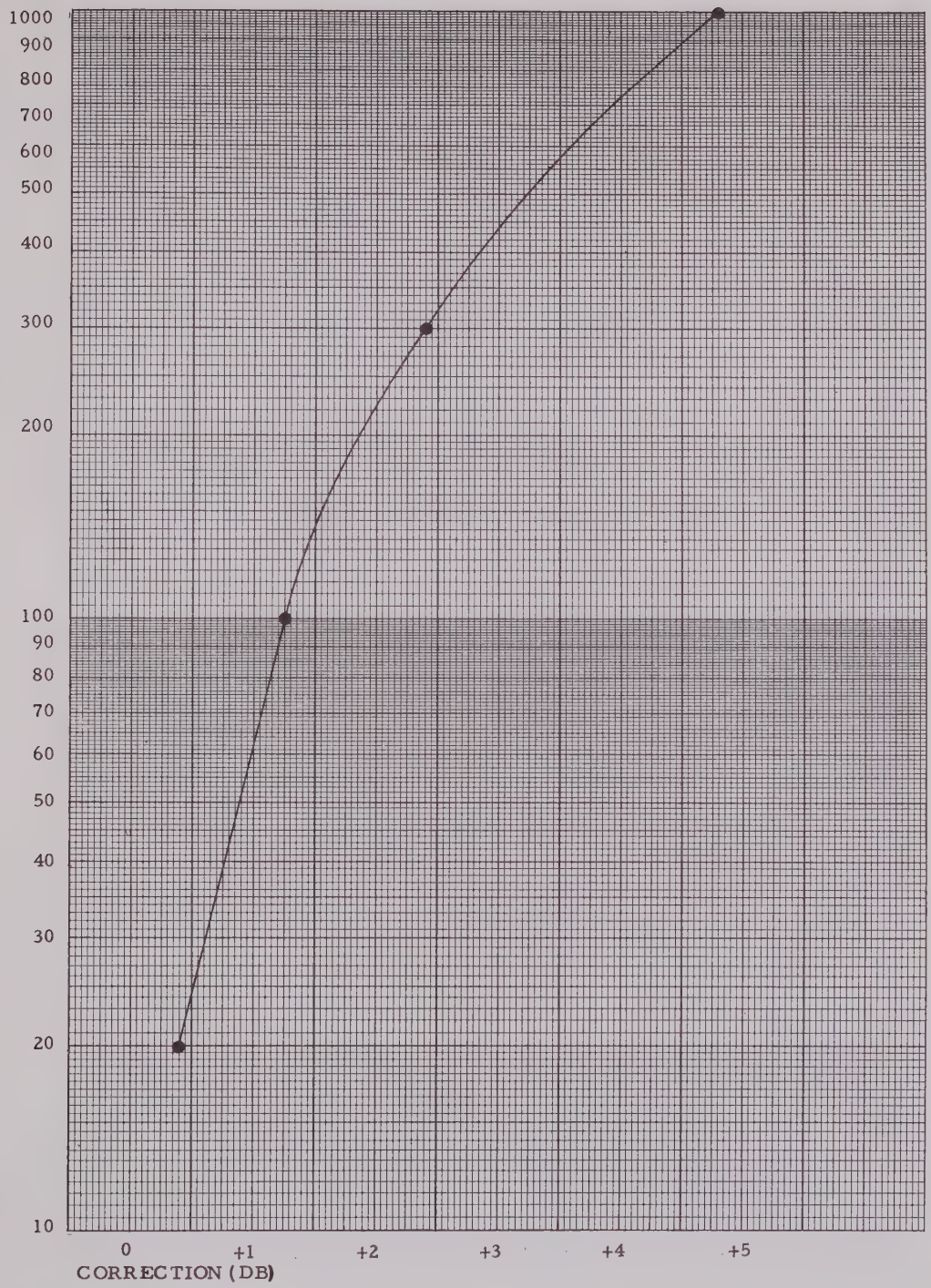


FIGURE 3-4 CORRECTION FACTOR FOR CABLE LOSSES

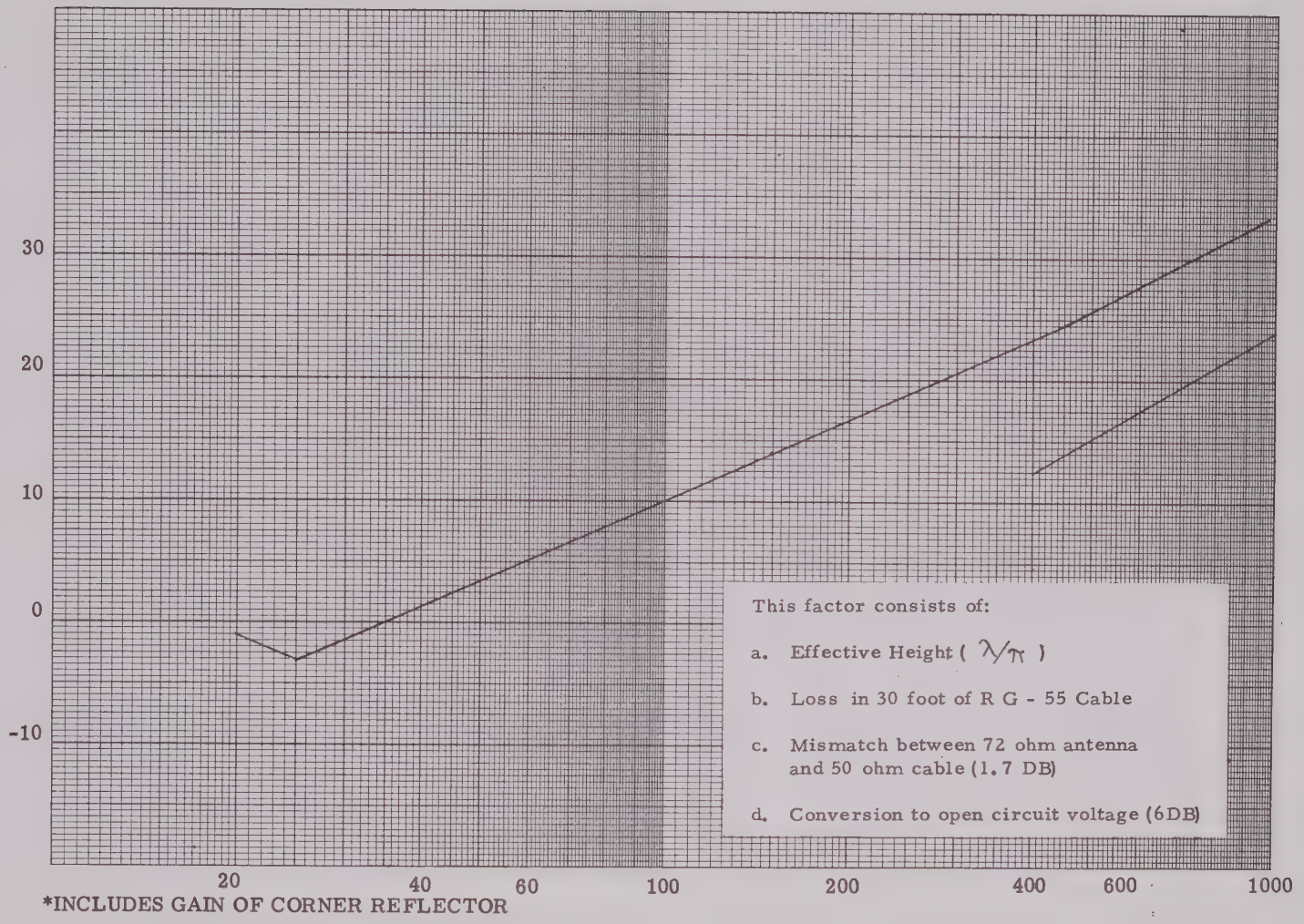


FIGURE 3-5. DIPOLE FACTOR (DB)

*INCLUDES GAIN OF CORNER REFLECTOR

UNIT #

SERIAL NO.

ANTENNA FACTOR FOR VERTICAL ANTENNA VA-105

BAND	FREQUENCY MC	DB
1	.150	
	.230	
	.260	
	.300	
	.330	
	.360	
2	.360	
	.400	
	.500	
	.600	
	.700	
	.800	
	.870	
3	.870	
	1.0	
	1.2	
	1.4	
	1.6	
	1.8	
	2.1	

BAND	FREQUENCY MC	DB
4	2.1	
	2.7	
	3.4	
	4.0	
	4.6	
	5.2	
5	5.2	
	6.0	
	7.0	
	8.0	
	9.0	
	10.0	
	11.0	
	12.7	
6	12.7	
	14.0	
	17.0	
	20.0	
	23.0	
	26.0	
	28.0	
	30.0	

FOR SUBSTITUTION MEASUREMENTS ADD 20 DB TO THE ABOVE FACTORS

FIGURE 3-6.

ANTENNA "FACTOR" FOR

LOOP ANTENNA LP-105

FREQUENCY		DB	FREQUENCY		DB
150	KC	41.0	2.4	MC	27.8
175	KC	40.0	2.7	MC	27.3
200	KC	39.5	3.0	MC	27.0
225	KC	38.8	3.4	MC	26.6
250	KC	38.3	3.7	MC	26.1
275	KC	37.8	4.0	MC	25.9
300	KC	37.3	4.4	MC	25.5
325	KC	36.9	4.7	MC	25.3
360	KC	36.5	5.2	MC	25.1
400	KC	36.5	6.0	MC	24.0
450	KC	36.0	7.0	MC	23.0
500	KC	35.5	8.0	MC	22.0
560	KC	35.0	9.0	MC	21.2
620	KC	34.4	10.0	MC	20.8
700	KC	34.0	11.0	MC	20.3
760	KC	33.5	12.0	MC	20.0
820	KC	33.0			
870	KC	32.8	12.7	MC	19.8
			15.0	MC	19.3
900	KC	32.5	19.0	MC	19.0
1000	KC	31.8	21.0	MC	18.6
1.1	MC	31.0	24.0	MC	18.4
1.3	MC	30.2	27.0	MC	18.2
1.5	MC	29.8	30.0	MC	18.0
1.7	MC	29.3			
1.9	MC	29.2			
2.1	MC	29.0			

FOR SUBSTITUTION MEASUREMENTS ADD 20 DB TO THE ABOVE FACTORS

FIGURE 3-7

ANTENNA "FACTOR"

FOR

LOOP ANTENNA LP-3-105

FREQUENCY (KC)	DB	FREQUENCY (MC)	DB
150	26.2	0.9	18.1
175	24.8	1.0	17.9
200	24.1	1.1	17.5
225	23.6	1.3	16.3
250	23.1	1.5	15.0
275	22.6	1.7	14.8
300	22.0	1.9	13.4
325	21.7	2.1	12.8
360	21.2		
		2.4	12.6
400	21.4	2.7	12.4
450	21.2	3.0	11.8
500	21.0	3.4	11.1
560	20.8	3.7	10.8
620	20.7	4.0	10.4
700	20.5	4.4	9.9
760	20.4	4.7	9.6
820	20.2	5.2	9.3
870	20.0		
		6.0	8.5
		7.0	8.2
		8.0	8.2
		9.0	8.5
		10.0	9.0
		11.0	9.0
		12.0	9.0

FOR SUBSTITUTION MEASUREMENTS ADD 20 DB TO THE ABOVE FACTORS

FIGURE 3-7A

ANTENNA "FACTOR"

'FOR

VERTICAL ANTENNA VX-105

UNIT # 000

BAND	FREQUENCY (KC)	DB
1	14	
	15	
	16	
	18	
	20	
	22	
	24	
	25	
2	25	
	30	
	35	
	40	
	45	
	50	
	55	
	60	
3	62	
	65	
	70	
	75	
	80	
	90	
	100	
	110	
	120	
	130	
	140	
	150	

NOTE: For substitution measurements, add 20 DB to the above factors.

FIGURE 3-8

ANTENNA "FACTOR"

FOR

LOOP ANTENNA LG-105

BAND	FREQUENCY (KC)	DB
1	14	37.7
	15	37.5
	16	37.4
	18	36.7
	20	36.3
	22	35.8
	24	35.2
	25	35.0
2	25	34.5
	30	34.2
	35	33.0
	40	32.0
	45	31.3
	50	31.5
	55	32.0
	60	32.0
3	62	30.5
	70	27.9
	80	25.5
	90	25.5
	100	26.0
	120	25.2
	140	26.5
	150	26.0

NOTE: For substitution measurements, add 20 DB to the above factors.

FIGURE 3-9

ANTENNA "FACTORS"

FOR

REMOTE VERTICAL ANTENNAS VR-1-105, VR-3-105

LOOP ANTENNA LG-105A

FREQUENCY (KC)	VR-1-105 (DB)	VR-3-105 (DB)	LG-105A (DB)
14	32.0	24.2	38.2
20	29.7	23.5	35.8
25	28.4	21.8	34.8
35	26.7	21.0	32.0
60	26.0	21.0	30.8
100	26.0	21.0	27.5
150	26.0	21.0	27.5

NOTE: For substitution measurements, add 20 DB to the above factors.

FIGURE 3-10

ANTENNA FACTORS FOR DIPOLES DM-105

FREQUENCY	DM-105 DB
20 MC	8.4
68 MC	9.0
132 MC	9.5
220 MC	10.0
330 MC	10.5
462 MC	11.0
620 MC	11.5
790 MC	12.0
940 MC	12.5
1000 MC	12.8

The factors shown include the following:

a. Loss in 30 feet of RG-55 cable.

b. Mismatch between 72 ohm antenna and 50 ohm load (1.7 DB).

c. Conversion to open circuit voltage (6 DB).

FIGURE 3-11.

CALIBRATION CHART FOR TUNING UNIT T-X/NF-105-F XY

SERIAL NO. 3366

BAND	FREQUENCY (KC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
1	14	100.0
	15	99.5
	16	99.0
	18	98.0
	20	97.5
	22	97.0
	24	97.0
	25	97.0
2	25	97.5
	30	97.0
	35	96.5
	40	96.0
	45	96.0
	50	96.0
	55	96.0
	60	96.0
3	62	96.5
	65	96.5
	70	96.0
	75	96.0
	80	96.0
	90	96.0
	100	96.0
	110	96.0
	120	96.0
	130	96.0
	140	96.0
	150	96.0

FIGURE 3-12

CALIBRATION CHART FOR TUNING UNIT T-A/NF-105-F XY

SERIAL NO. 5366

FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC	FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC	FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
.150	86.5	.870	78.5	5.2	75.0
.174	86.0	.900	78.5	6.0	75.0
.200	85.5	1.0	78.5	7.0	74.5
.225	85.5	1.1	78.5	8.0	74.5
.250	85.0	1.3	77.5	9.0	74.5
.275	85.0	1.5	78.0	10.0	74.5
.300	84.5	1.7	77.5	11.0	74.0
.325	84.0	1.9	77.0	12.0	74.0
.360	81.5	2.1	76.5	12.7	74.0
.360	81.0	2.1	75.0	12.7	74.5
.400	80.5	2.4	75.0	15.0	74.5
.450	80.0	2.7	74.5	19.0	74.5
.500	79.5	3.0	74.0	21.0	74.0
.560	79.0	3.4	73.5	24.0	74.0
.620	78.0	3.7	73.5	27.0	74.0
.700	76.0	4.0	74.0	30.0	74.5
.760	74.5	4.4	73.5		
.820	74.5	4.7	74.0		
.870	75.5	5.2	74.5		

FIGURE 3-13

BANDWIDTH DATA AND CALIBRATION CHART FOR
TUNING UNIT, T-1/NF-105-F XY

SERIAL NO. 3366

FREQ. MC	BANDWIDTH IN MC	BANDWIDTH FACTOR IN DB	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
20	.159		56.0
30	.112		59.0
40	.119		58.5
50	.119		58.5
60	.119		58.5
65	.113		57.5
62	.150		56.5
80	.141		57.0
100	.141		57.0
120	.141		57.0
140	.141		57.0
160	.141		57.0
180	.141		57.0
200	.141		57.0

FIGURE 3-14

BANDWIDTH DATA AND CALIBRATION CHART FOR
TUNING UNIT, T-2/NF-105-F^{XY}

SERIAL NO. 3366

FREQ. MC	BANDWIDTH IN MC	BANDWIDTH FACTOR IN DB	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
160	.251		52.0
200	.251		52.0
210	.251		52.0
220	.202		51.0
240	.237		52.5
260	.237		52.5
280	.237		52.5
300	.237		52.5
320	.237		52.5
340	.237		52.5
360	.224		53.0
380	.224		53.0
400	.224		53.0

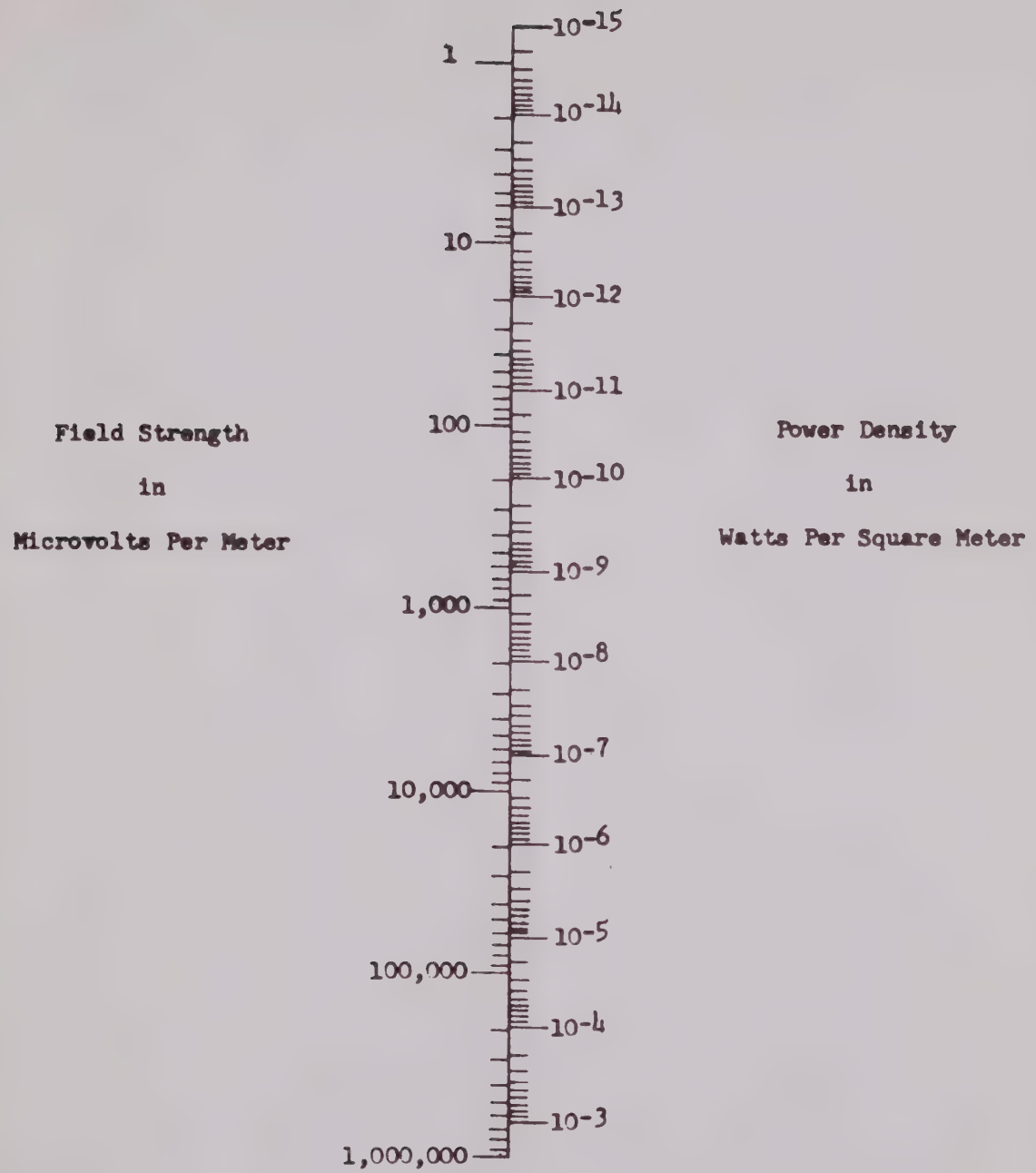
FIGURE 3-15

CALIBRATION CHART FOR TUNING UNIT T-3/NF-105-F XY

SERIAL NO. 3366

FREQUENCY IN MC	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
400	51.0
425	50.5
450	50.0
475	50.5
500	51.0
525	51.0
550	51.0
575	51.0
600	51.0
625	51.5
650	52.0
675	51.5
700	51.0
700	52.0
725	52.0
750	52.0
775	52.5
800	52.5
825	52.0
850	52.0
875	51.5
900	51.0
925	50.0
950	49.5
975	48.0
1000	47.0

FIGURE 3-16

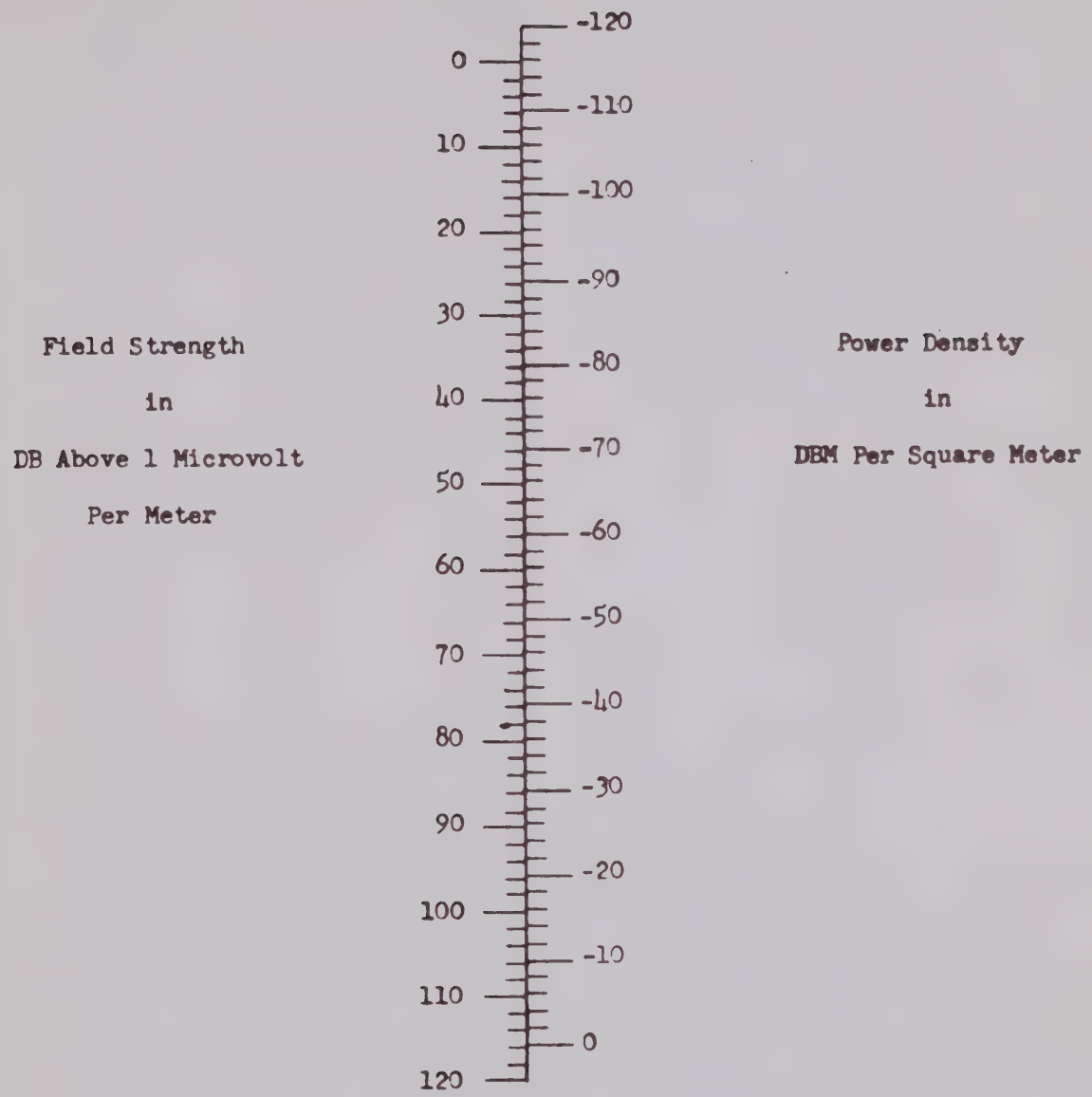


CONVERSION CHART

FIELD STRENGTH to POWER DENSITY

-- Microvolts Per Meter to Watts Per Square Meter

FIGURE 3-17

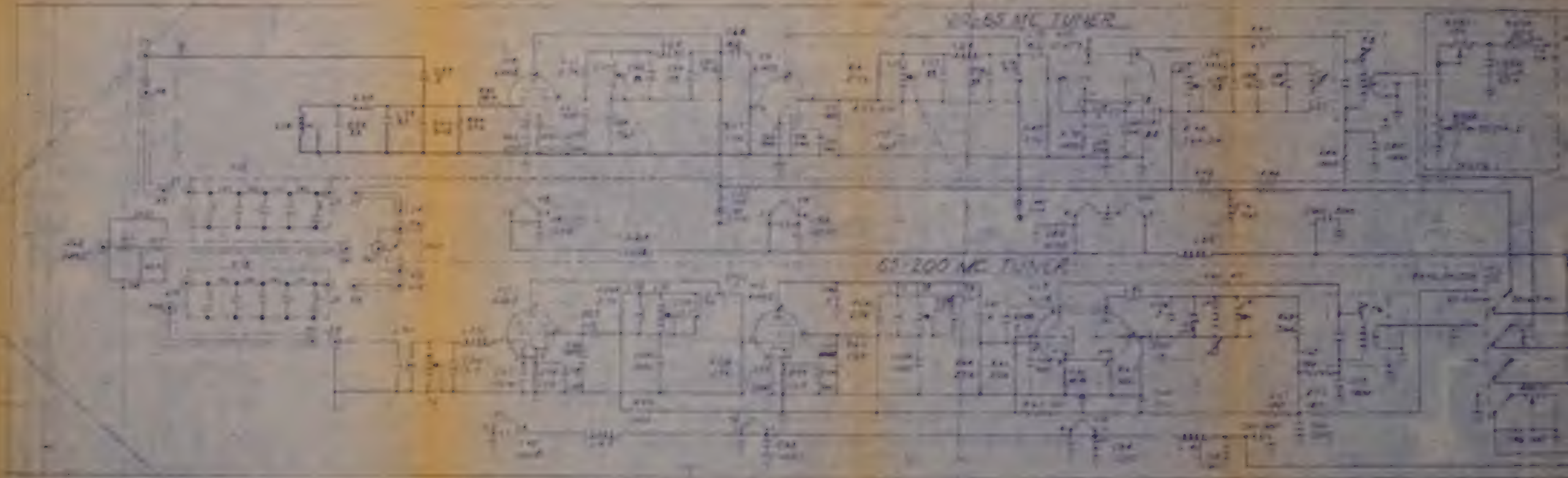


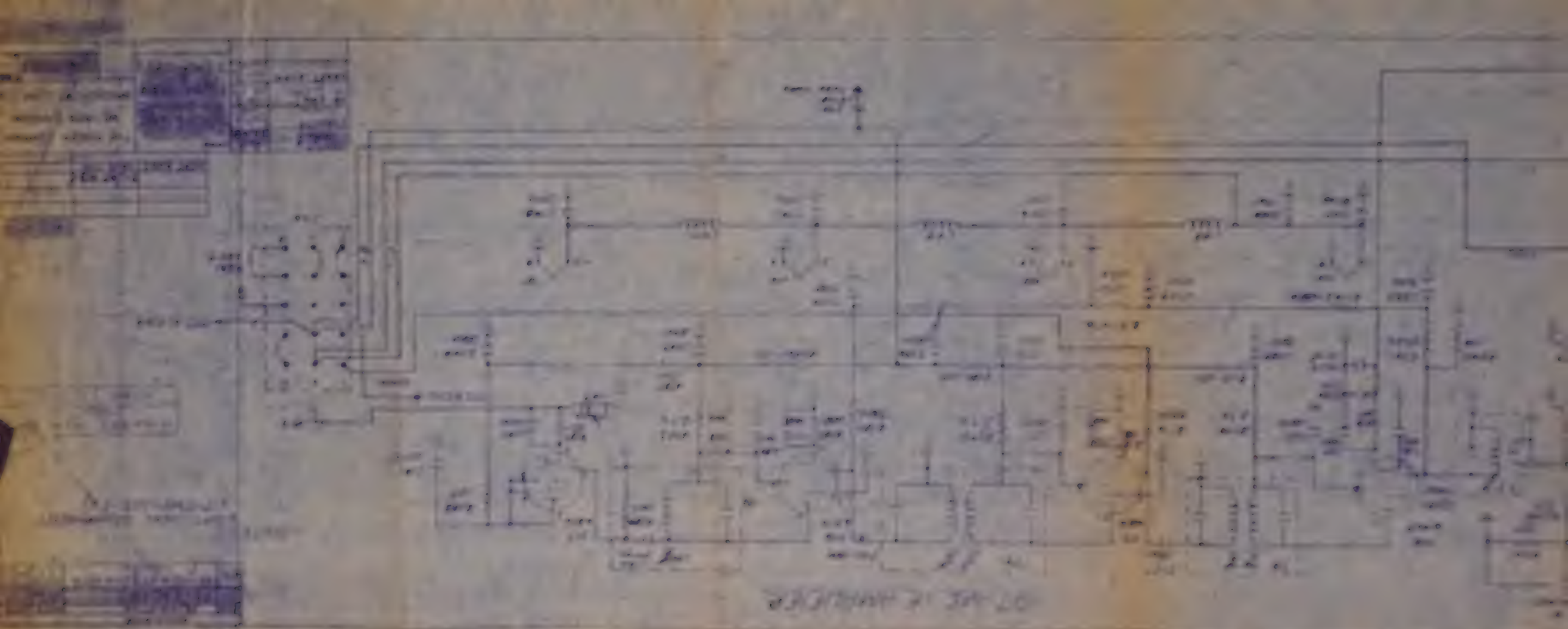
CONVERSION CHART

FIELD STRENGTH to POWER DENSITY

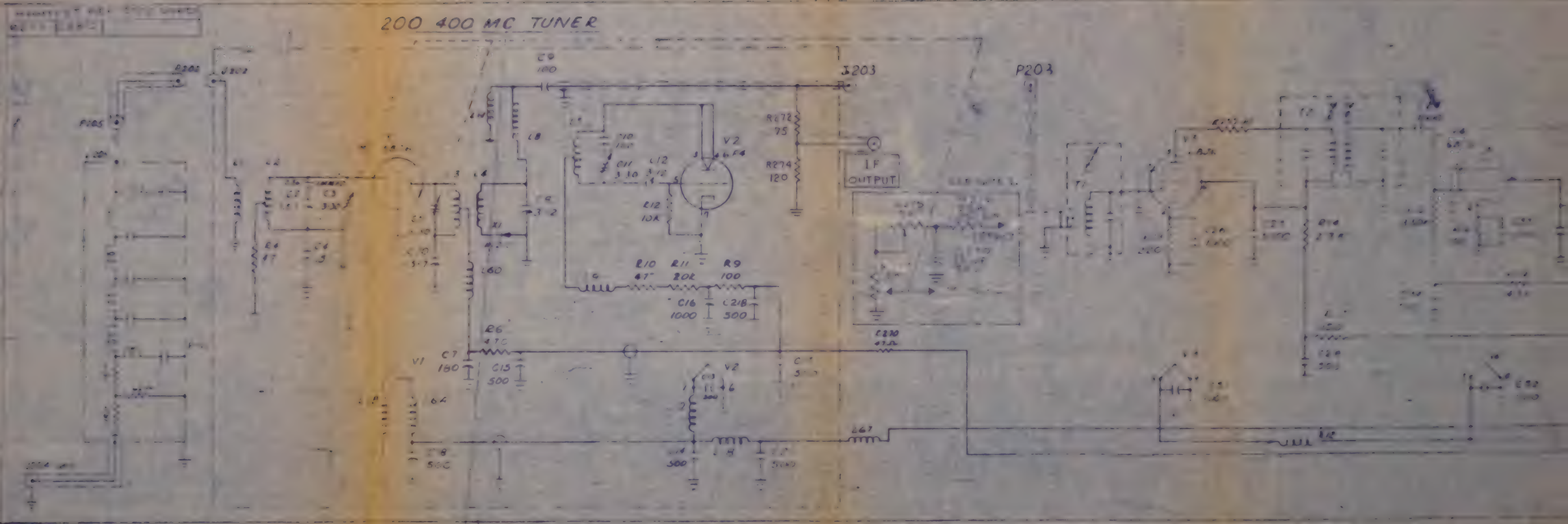
-- DB Above 1 Microvolt Per Meter to DBM Per Square Meter

FIGURE 3-18

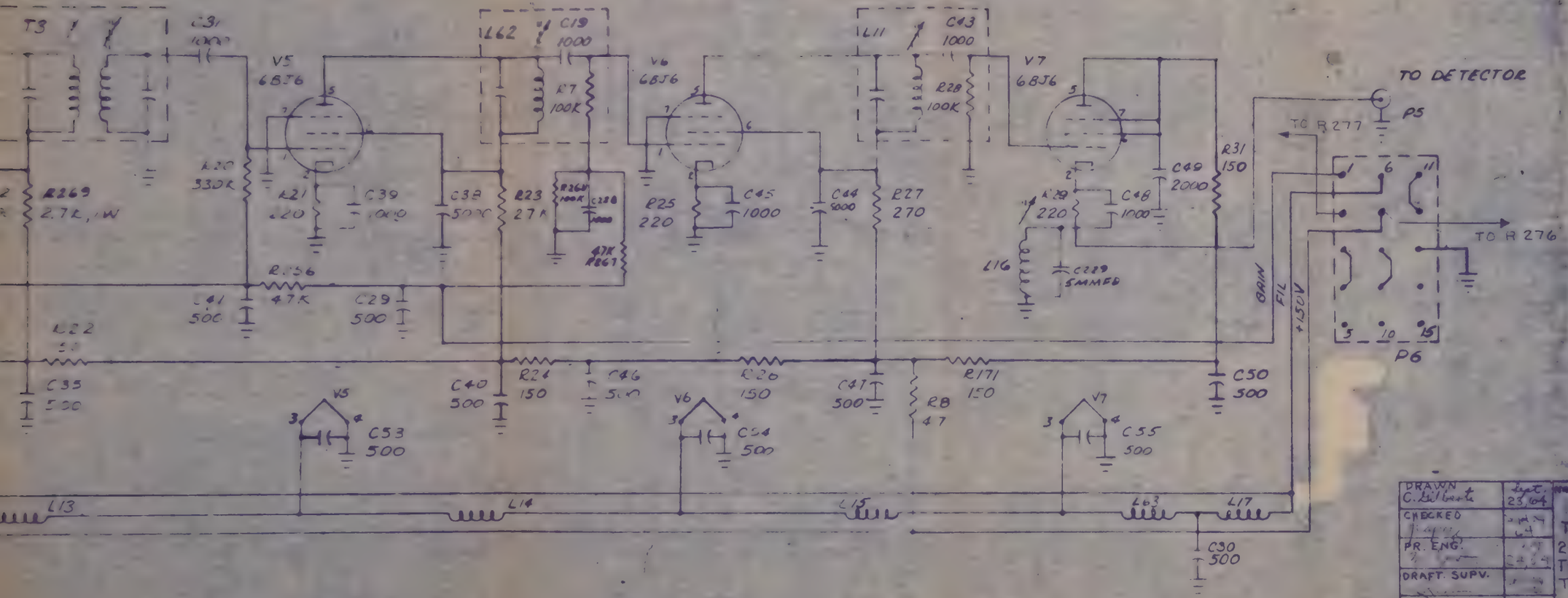

65-200 MC TUNER



200 400 MC TUNER



30 MC I.F. AMPLIFIER

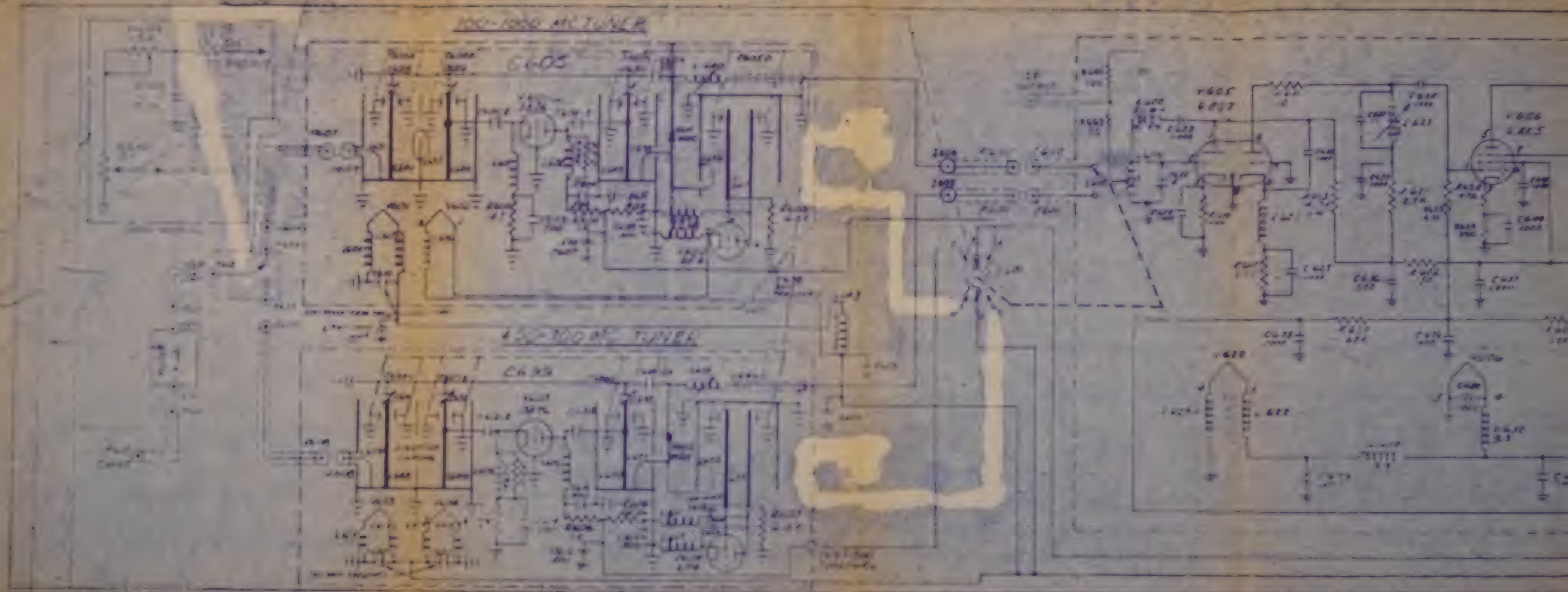


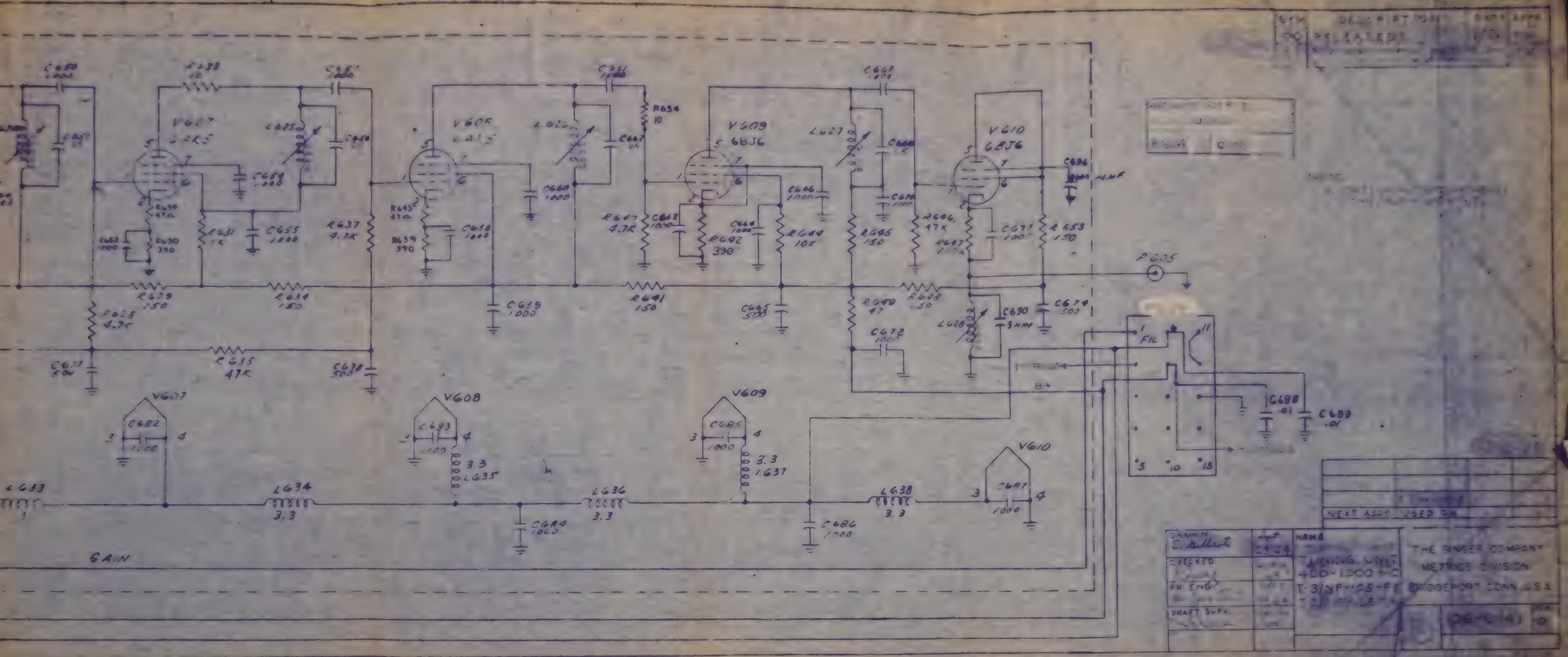
SYM	DESCRIPTION	DATE	APP.
00	RELEASED		

T-2/NF-105-F

NEXT ASSY USED ON

DRAWN C. Gilbert	Sept. 23 '64	THE SINGER COMPANY METRICS DIVISION BRIDGEPORT, CONN., U.S.A.
CHECKED		TUNING UNIT 200-400 MC T-2/NF-105-F T-2/NF-105FX
PR. ENG.		
DRAFT. SUPV.		106-0140 C1

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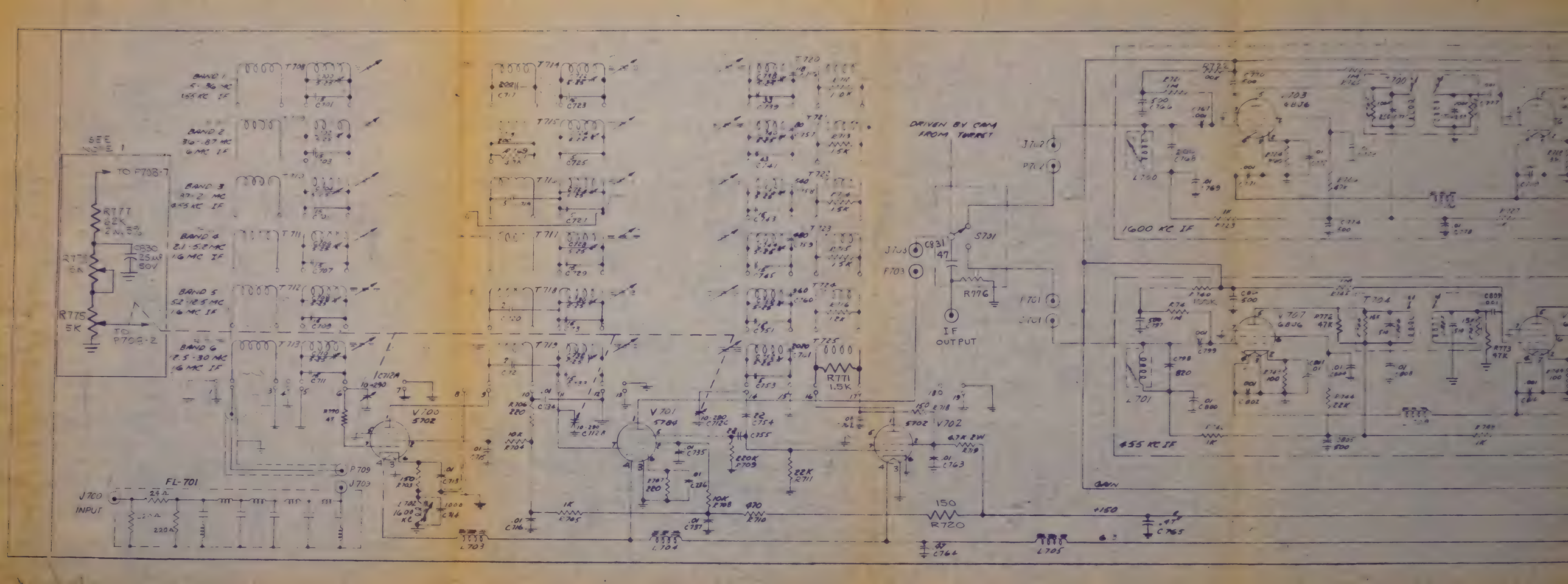
V608 6AL5
V609 6BJ6
V610 6BJ6
C650 1000
R638 10
C656 1000
L625
C657 .5
C658 1000
R639 47Ω
R630 390
C652 1000
R631 1K
C655 1000
R637 4.7K
R629 150
R634 150
R635 4.7K
C637 .5M
C635 47K
C638 500
R643 47Ω
R639 390
C650 1000
C659 1000
C660 1000
L626
C661 .5
R634 10
R641 4.7K
C663 1000
R642 390
C664 1000
R644 10K
C665 500
R641 150
C666 1000
L627
C667 .5
C668 1000
R645 150
R646 47K
R647 220Ω
C673 100
R653 150
C686 MMF
P605
R640 47
C672 1000
L628
C690 3MM
C674 500
R648 150
C688 .01
C689 .01
FIL
B+
V607
C682 1000
V608
C683 1000
3.3
L635
V609
C685 1000
3.3
L637
V610
C687 1000
L633
L634
3.3
L636
3.3
C684 1000
C686 1000
L638
3.3
GAIN
5
10
15
HEAT ASSY USED ON
DRAWN C. Gilbert
CHECKED
ENG
DRAFT SUPV.
NAME
TUNING UNIT
400-1000 MC
T-313F-105-FF
THE SINGER COMPANY
METRICS DIVISION
BRIDGEPORT CONN. U.S.A.
06-C141
REV


BAND 1
5-36 MC
455 KC IF
BAND 2
36-87 MC
6 MC IF
BAND 3
87-2 MC
455 KC IF
BAND 4
2.1-5.2 MC
16 MC IF
BAND 5
5.2-12.5 MC
16 MC IF
BAND 6
12.5-30 MC
16 MC IF
SEE NOTE 1
TO P708-7
TO P708-2
R777 62K 2W, 5%
C830 25MF 50V
R776 5K
R775 5K
T708
T709
T710
T711
T712
T713
T714
T715
T716
T717
T718
T719
T720
T721
T722
T723
T724
T725
C701
C703
C705
C707
C709
C711
C713
C715
C717
C719
C721
C723
C725
C727
C729
C731
C733
C735
C737
C739
C741
C743
C745
C747
C749
C751
C753
C755
C757
C759
C760
R709 3.9K
R771 1.5K
R772 15K
R773 15K
R774 15K
R775 15K
R776 12K
DRIVEN BY CAM FROM TURRET
J702
P702
J705
P703
C831 47
S701
R776
IF OUTPUT
J701
P701
V700 5702
V701 5784
V702 5702
C712A 10-290
C712B 10-290
C712C 10-290
R704 220
R705 1K
R706 220
R707 220
R708 10K
R709 220K
R710 470
R711 22K
R718 150
R719 47K
C716
C734
C736
C746
C763
C764
C765
R720 150
L702 1600 KC
L703
L704
L705
FL-701
J700 INPUT
24Ω
220Ω
P709
J703
1600 KC IF
455 KC IF
V703 6BJ6
V704 6BJ6
V707 6BJ6
R722 47K
R773 47K
L700
L701
C769
C770
C771
C772
C773
C774
C776
C777
C778
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C780
C781
C782
C783
C784
C785
C786
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C799
C800
C801
C802
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C804
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C806
C807
C808
C809
R760 100K
R761 1M
R762 1M
R763 1M
R764 1M
R765 1M
R766 1M
R767 1M
R768 1M
R769 1M
R770 1M
R771 1M
R772 1M
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R774 1M
R775 1M
R776 1M
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R778 1M
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R780 1M
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R783 1M
R784 1M
R785 1M
R786 1M
R787 1M
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R990 1M
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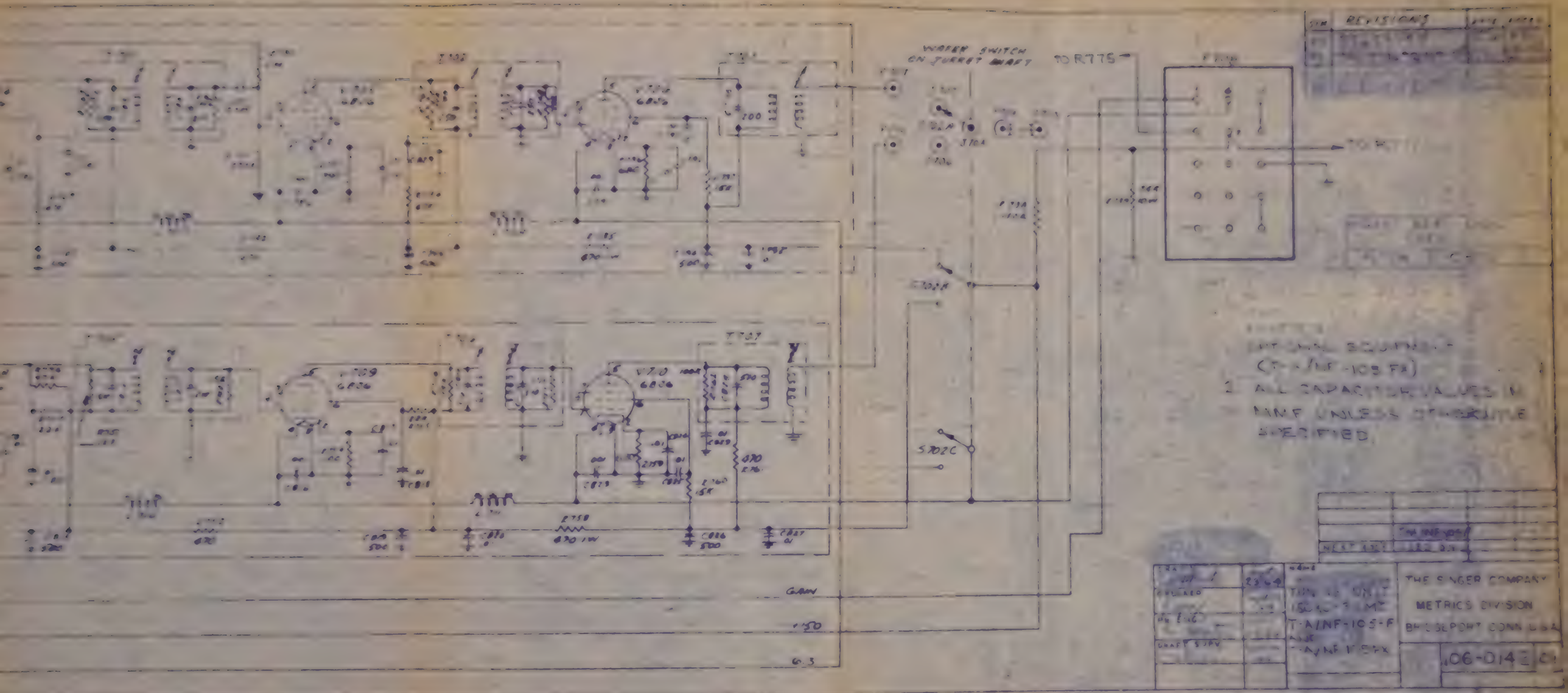
R995 1M
R996 1M
R997 1M
R998 1M
R999 1M
R1000 1M



REVISIONS

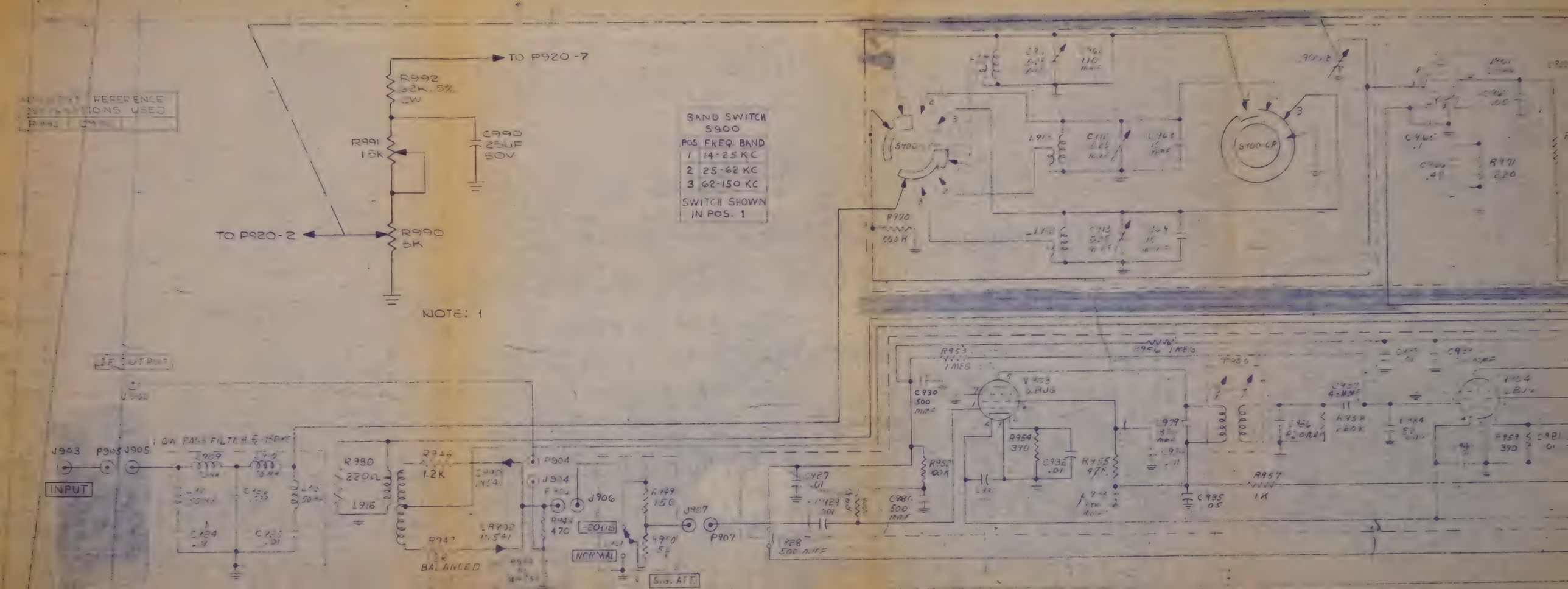
EXTERNAL EQUIPMENT (T-A/INF-105 FA)

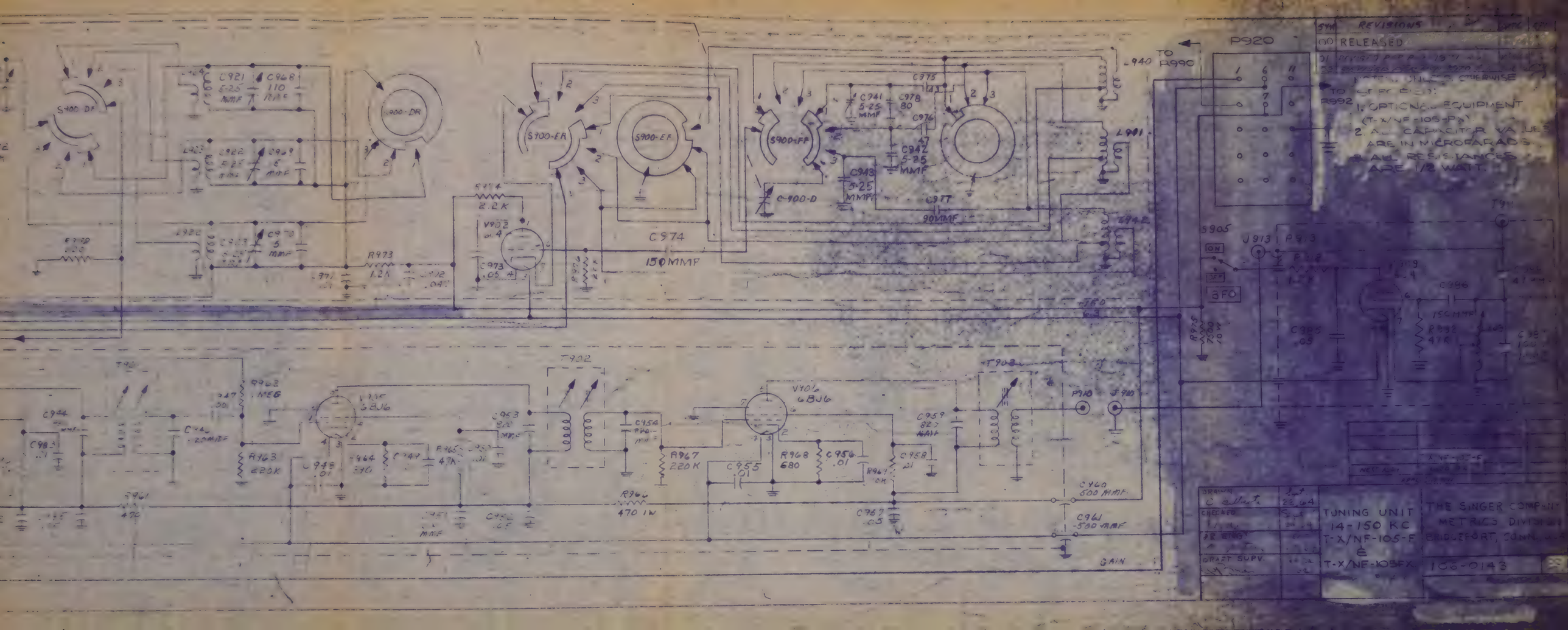
1. ALL CAPACITOR VALUES IN MMF UNLESS OTHERWISE SPECIFIED.

THE SINGER COMPANY
METRICS DIVISION
BRIDGEPORT CONN U.S.A.

TITLE AS UNIT
T-A/INF-105-F
AN/GRC-9 MOD
T-A/INF-105-FX

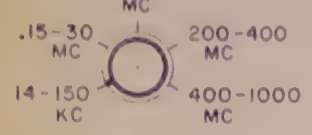
106-0142 C1


REFERENCE
DESIGNATIONS USED
TO P920-7
R992
62K, 5%
2W
R991
15K
C990
25UF
50V
TO P920-2
R990
5K
NOTE: 1
BAND SWITCH
S900
POS FREQ BAND
1 14-25 KC
2 25-62 KC
3 62-150 KC
SWITCH SHOWN
IN POS. 1
S900
S900-CR
R970
562K
C946
.1
C947
.47
R971
220
IF OUTPUT
J903
P905
J905
INPUT
LOW PASS FILTER @ 150 KC
L909
L910
C924
.47
C925
.01
L916
R980
220Ω
R946
1.2K
C920
.1
R947
2K
BALANCED
R902
11.5Ω
P904
J904
J906
R949
150
R950
470
-20 DB
NORMAL
R951
470
SIG. ATT.
J907
P907
R953
1 MEG
R956
1 MEG
C930
500
MMF
V903
6AU6
R954
390
C932
.01
R955
47K
C927
.01
C928
500 MMF
R952
100K
C929
500 MMF
C933
.01
R957
1K
C935
.05
T901
C952
4-MMF
R958
680K
V904
6BJ6
R959
390
C981
.01


S900-DF
S900-DR
S900-ER
S900-EF
S900-FF
C900-D
C921 6-25 MMF
C968 110 MMF
C922 6-25 MMF
C969 5 MMF
C923 6-25 MMF
C970 5 MMF
C974 150MMF
C971 .01
C972 .047
R970 220
R973 1.2K
R974 2.2K
V902 6AJ8
C973 .05
R975 47K
C975
C741 5-25 MMF
C978 80
C976 47
C942 5-25 MMF
C943 5-25 MMF
C977 90MMF
L940
L941
L942
TO R990
P920
S905
ON
OFF
BFO
J913
P913
T901
C946
150MMF
R938 47K
C945 .05
C947 100
R945 220
T902
T903
P910
J910
C944
C983 .01
C945 .02MMF
R962 1 MEG
.047 .05
V901 6BJ6
C948 .01
R963 220K
R964 330
C949
R965 47K
C950 .01
C953 820 MMF
C954 250 MMF
R967 220K
C955 .01
R968 680
C956 .01
R969 10K
C958 .01
C959 82 MMF
C957 .05
C960 500 MMF
C961 500 MMF
R966 470 1W
C951 MMF
C952 .05
R961 470
GAIN
TO P990
REVISIONS
SYM
00 RELEASED
UNLESS OTHERWISE
TO BE USED:
R992
1. OPTIONAL EQUIPMENT
(T-X/NF-105-PX)
2. ALL CAPACITOR VALUES
ARE IN MICROFARADS
3. ALL RESISTANCES
ARE 1/2 WATT
DRAWN
C Gillett
CHECKED
ENGR
DRAFT SUPV.
TUNING UNIT
14-150 KC
T-X/NF-105-F
&
T-X/NF-105FX
THE SINGER COMPANY
METRICS DIVISION
BRIDGEPORT, CONN.
108-0143

ISSUE	PLN NO	CHANGE	DATE	APP	ISSUE	PLN NO	CHANGE	DATE	APP	ISSUE	PLN NO	CHANGE	DATE	APP	ISSUE	PLN NO	CHANGE	DATE	APP

(S201) FREQUENCY RANGE



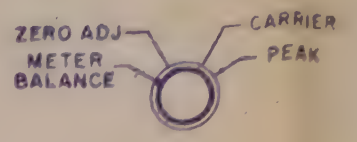
(S205)

(S207) FOR TX USE OUTER SCALE

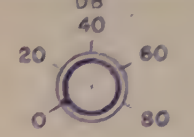
IMPULSE GENERATOR DB ABOVE 1μv/MC

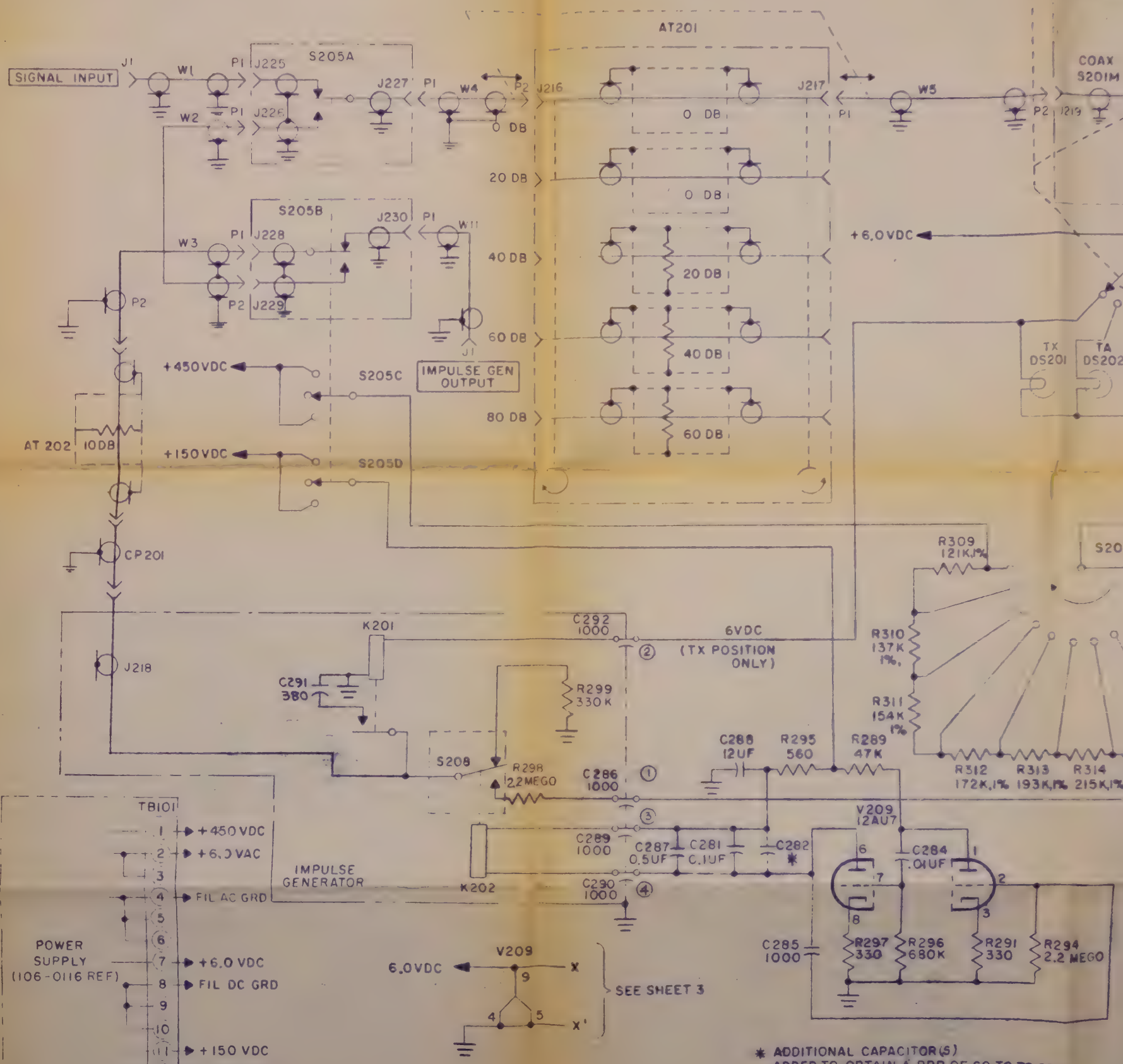
(S206)

(S202)

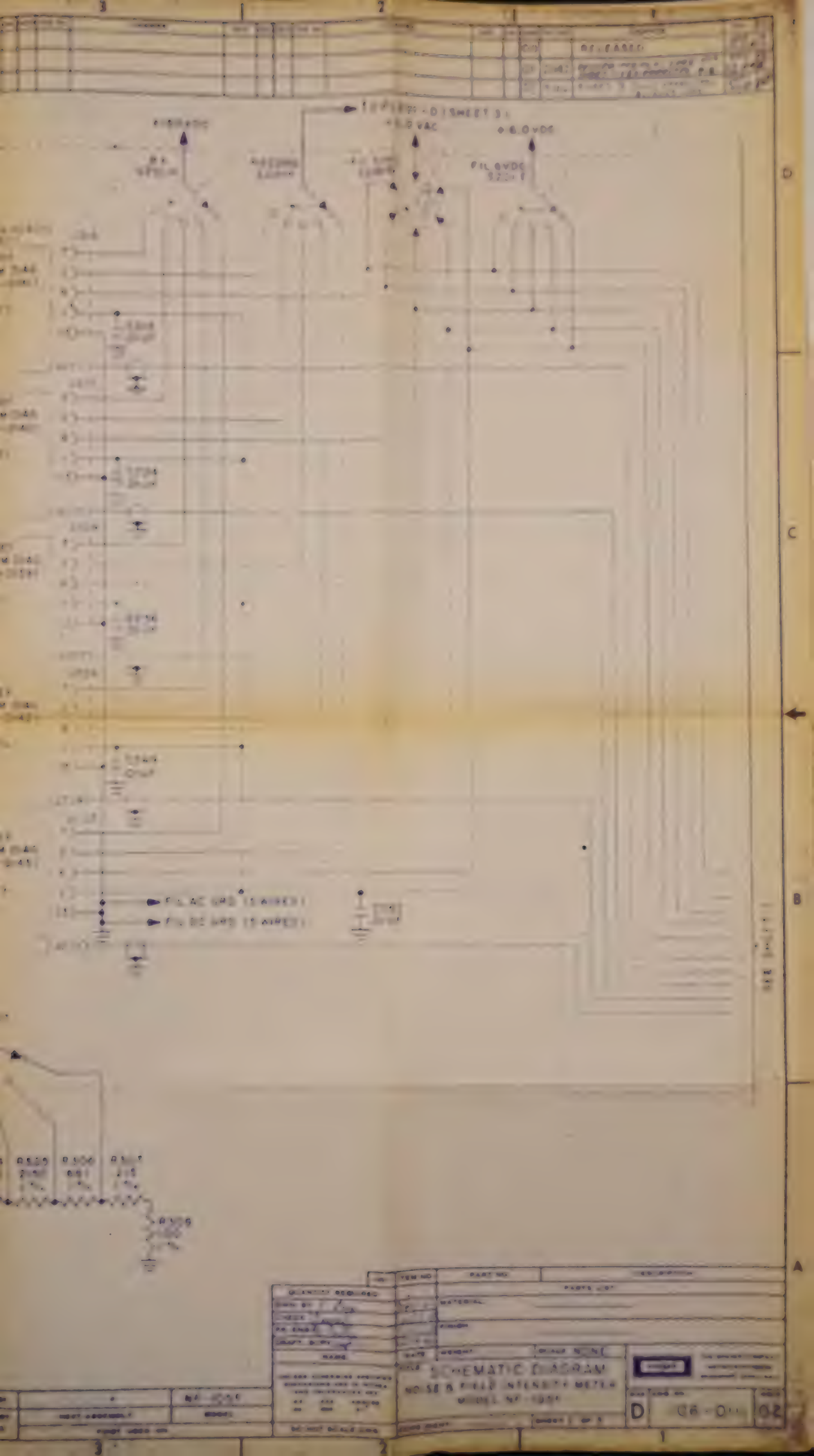


(AT201) SIGNAL ATTENUATOR DB





NOTES: UNLESS OTHERWISE SPECIFIED


RELEASED
6.0 VAC
6.0 VDC
SCHEMATIC DIAGRAM
NOISE & FIELD INTENSITY METER
D
06-0
02

8	7	6	5	4

CHANGE	DATE	CHK	ISSUE	PCN NO

SEE SHEET 1

C207 100
C208 1000
R206 4700
R207 22K
C209 100
C210 1000
R208 22K
R209 22K

C201 220
C202 100
R201 47K
C203 220
C204 100
R202 220K
C205 1000
R203 100K
R204 220K

V201
6BJ7
T3 DETECTOR

C206 2.2
C295 1000
C211 12
R321 22K
R205 22K
R210 18K

C213 100
C220 1000
R216 4700
R217 22K
C221 100
C222 1000
R218 22K
R219 22K

V202
6BJ7
T2 DETECTOR

C218 2.2
C296 1000
C223 18
C224 6.2
R322 22K
R215 22K
R220 18K

C213 220
C214 100
R211 47K
C215 220
C216 100
R212 220K
C217 1000
R213 100K
R214 220K

C231 100
C232 1000
R226 4700
R227 22K
C233 100
C234 1000
R228 22K
R229 22K

V203
6BJ7
T1 DETECTOR

C230 4.7
C297 1000
C235 47
C236 3.9
R323 22K
R225 22K
R230 18K

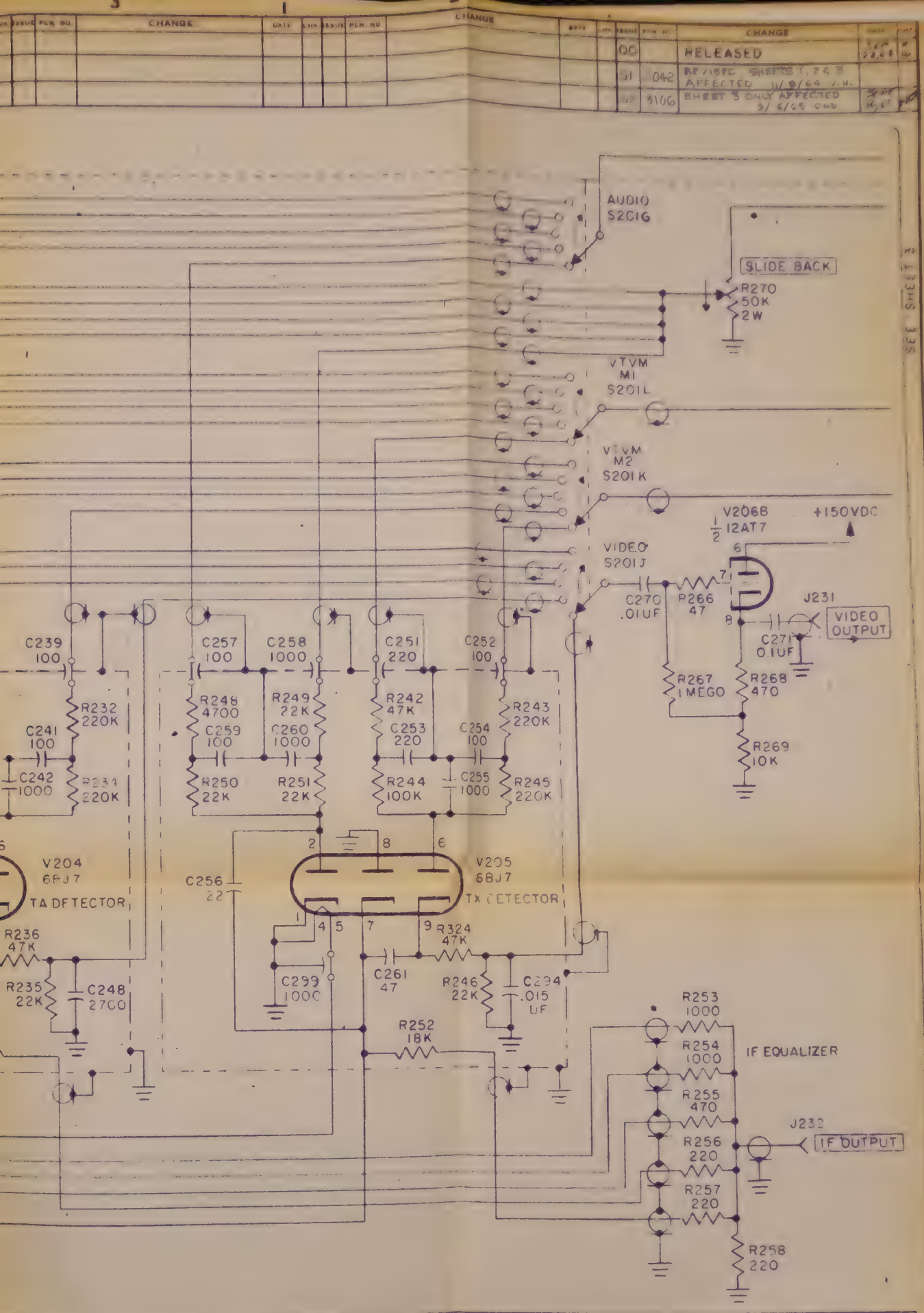
C225 220
C226 100
R221 47K
C227 220
C228 100
R222 220K
C229 1000
R223 100K
R224 220K

C244 100
C245 1000
R237 4700
R238 22K
C246 100
C247 1000
R239 22K
R240 22K

C237 10
C238 1000

NOTES UNLESS OTHERWISE SPECIFIED

CHANGE	DATE	APP'D	ISSUE	PCN NO.
RELEASED			00	
REVISED SHEETS 1, 2 & 3 AFFECTED W/ 9/64 V.M.			01	042
SHEET 3 ONLY AFFECTED 3/6/65 GMD			02	3106



-001	ITEM NO.	PART NO.	DESCRIPTION
QUANTITY REQUIRED		PARTS LIST	
DWN. BY E. Ray		MATERIAL	
CHECK		FINISH	
PR. ENG.			
DRAFT. SUPV.			
NAME	DATE	WEIGHT	SCALE NONE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE .XX ±.02 .XXX ±.005 ANGLES ±1°

DO NOT SCALE DWG.

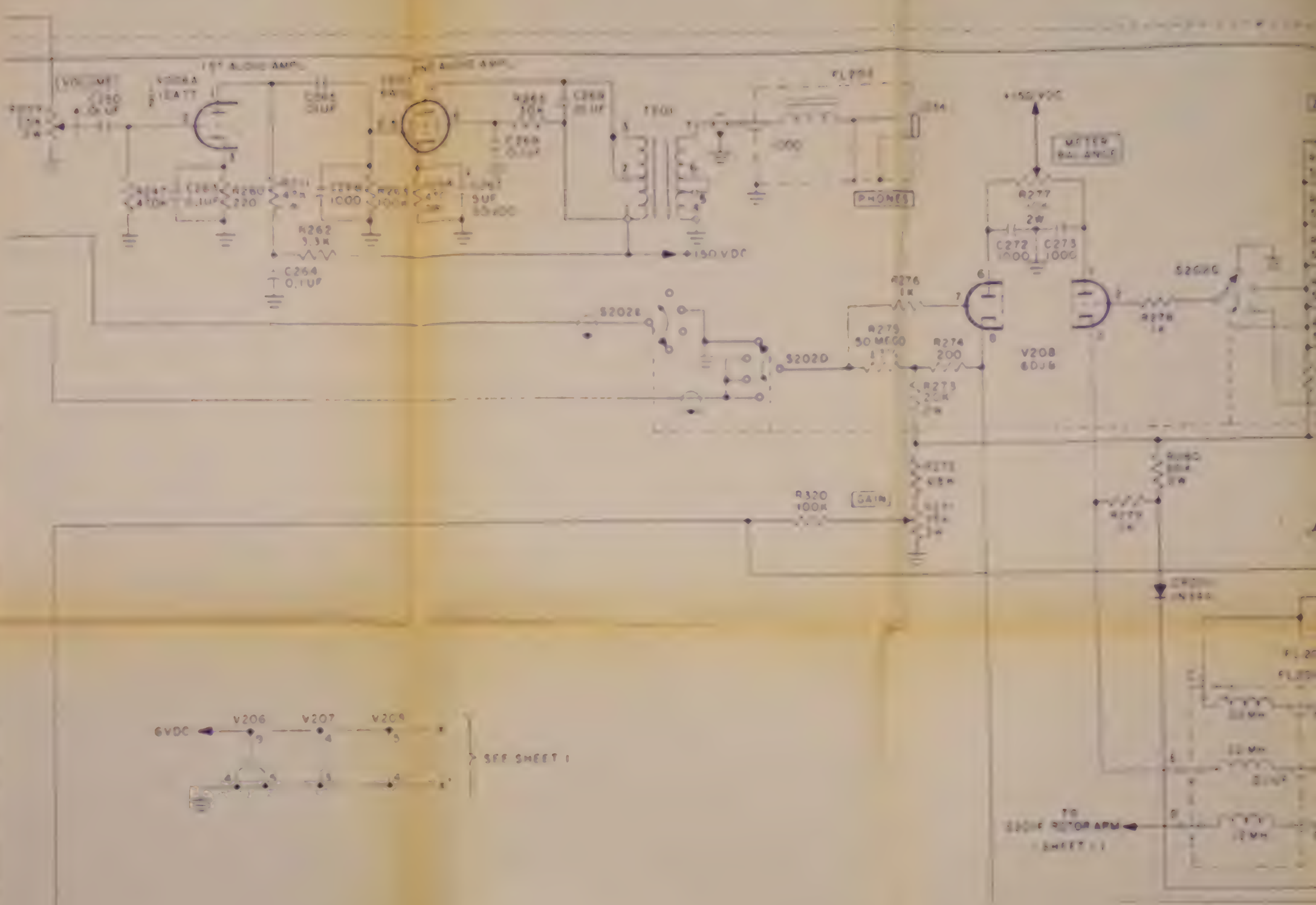
TITLE SCHEMATIC DIAGRAM
NOISE & FIELD INTENSITY METER
MODEL NF-105F

CODE IDENT —— SHEET 2 OF 3

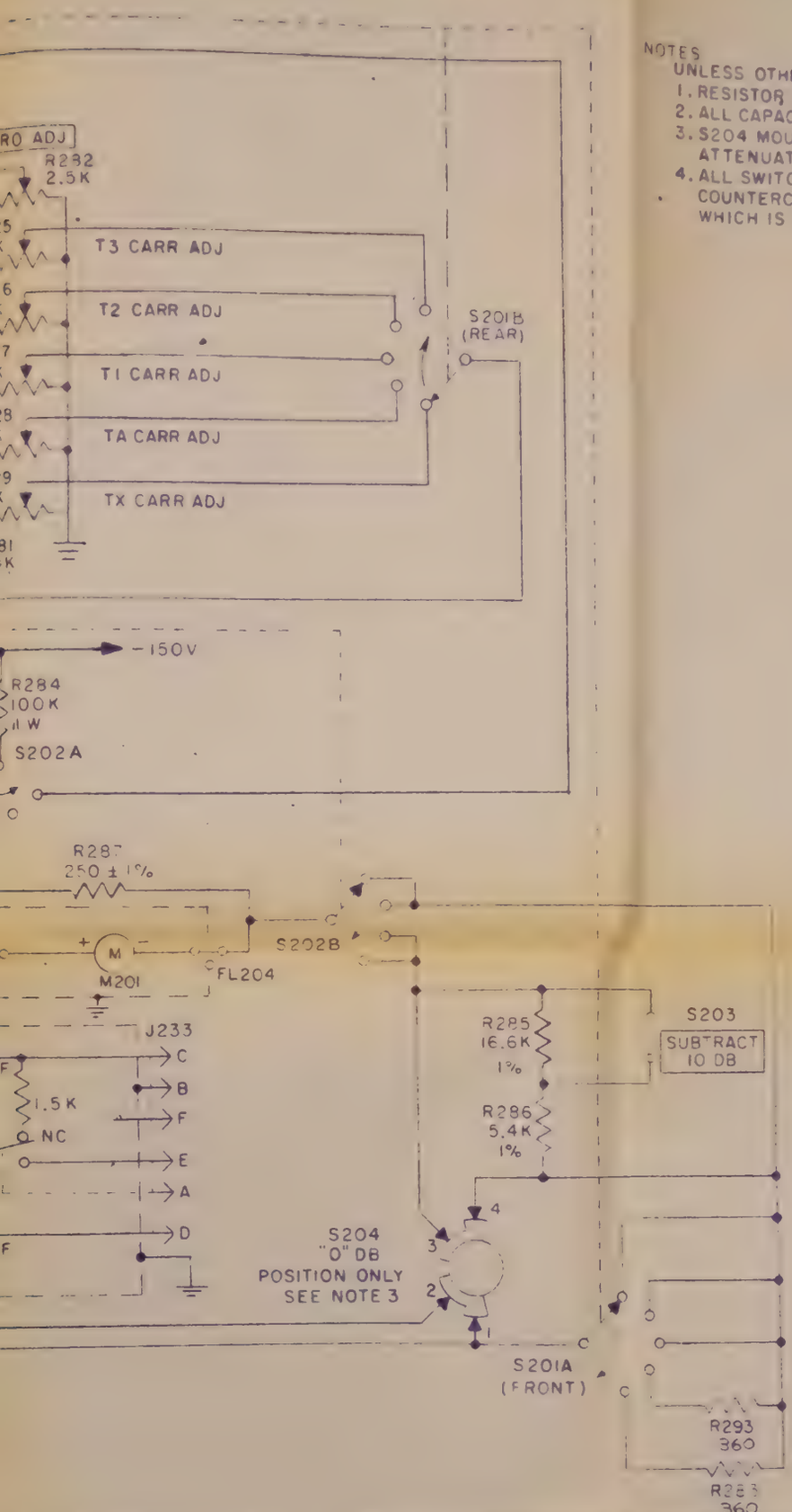
SINGER — THE SINGER COMPANY METRICS DIVISION BRIDGEPORT, CONN. U.S.A.

SIZE D | DWG. NO. 106-0111 | ISSUE 02

-001		NF-105F
PART NO.	NEXT ASSEMBLY	MODEL
	FIRST USED ON	


1ST AUDIO AMP.
2ND AUDIO AMP.
VOLUME
VOL-A BATT
R277 2W
C272 1000
C273 1000
R276 1K
R279 50 MEGO
R274 200
R273 22K 2W
V208 6DJ6
S202G
S202E
S202D
R262 9.3K
C264 0.1UF
R320 100K
GAIN
PHONES
+150 VDC
METER BALANCE
6VDC
V206
V207
V209
SEE SHEET 1
TO SIGNAL ROTOR ASM (SHEET 11)

DATE	CHK	ISSUE	PCN NO	CHANGE
		00		RELEASED
		01	[illegible]	REVISED, SHEET [illegible] AFFECTED
		02	3.06	R272 WAS 100K, SHEET 3 ONLY AFFECTED



NOTES
UNLESS OTHERWISE SPECIFIED
1. RESISTOR VALUES ARE IN OHMS, 1/2W,
2. ALL CAPACITANCE VALUES ARE IN UUF.
3. S204 MOUNTED ON REAR OF AT201 (SIGNAL ATTENUATOR), AND SHOWN IN "0" DB POSITION.
4. ALL SWITCHES SHOWN IN THE FURTHEST COUNTERCLOCKWISE POSITION EXCEPT S205 WHICH IS SHOWN IN "READ" POSITION.

HIGHEST REF DESIGNATION USED
R329 C299 J234

ITEM NO.	PART NO.	DESCRIPTION
	PARTS LIST	

QUANTITY REQUIRED
DWN. BY
CHECK
PR. ENG.
DRAFT. SUPV.
NAME
DATE
MATERIAL
FINISH
WEIGHT
SCALE NONE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE .XX ±.02 .XXX ±.005 ANGLES ±1°
DO NOT SCALE DWG.

TITLE
SCHEMATIC DIAGRAM
NOISE & FIELD INTENSITY METER
MODEL NF-105F

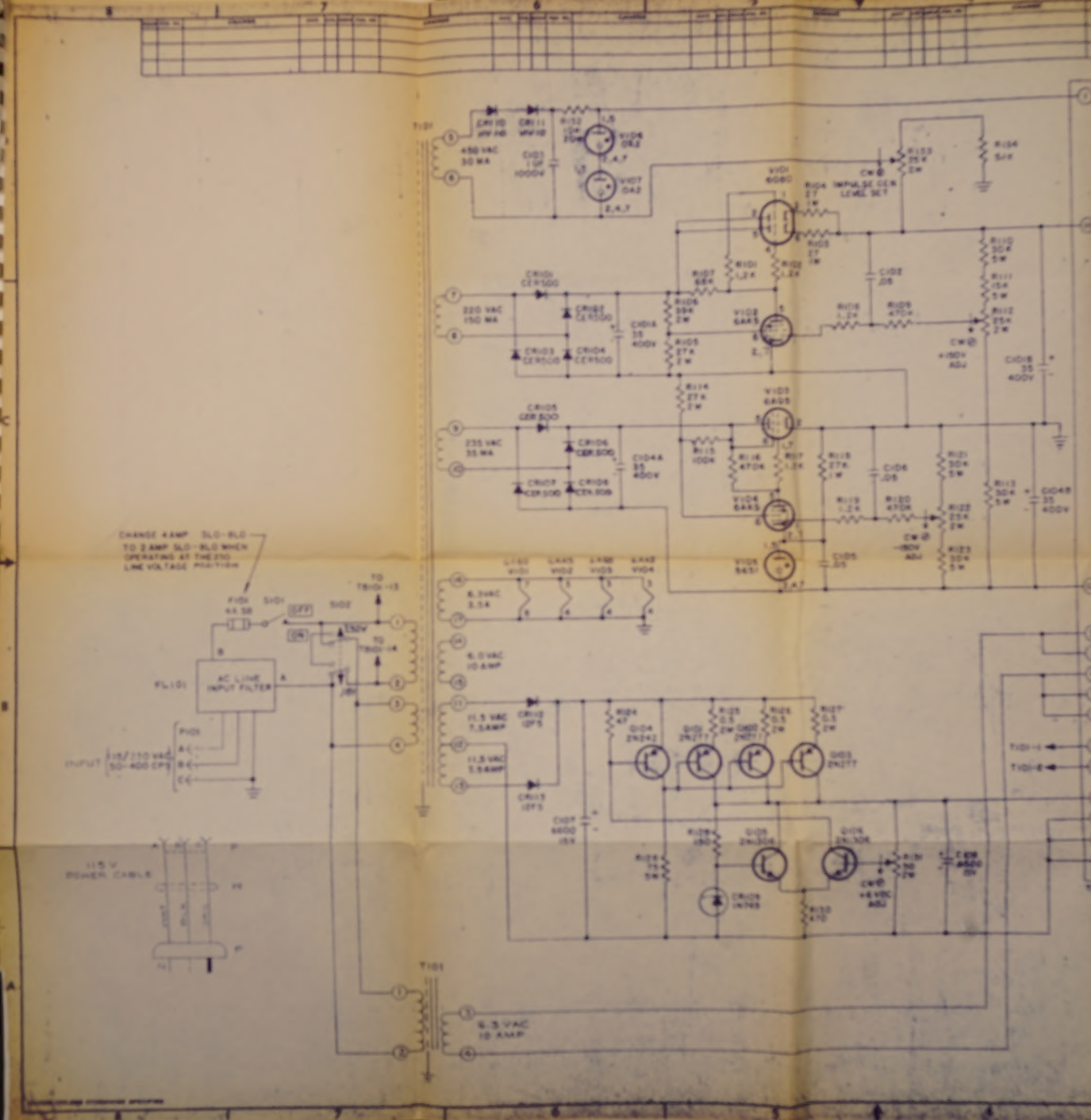
CODE IDENT
SHEET 3 OF 3

SINGER
THE SINGER COMPANY
METRICS DIVISION
WALLINGFORD, CONN., U.S.A.

SIZE D
DWG. NO. 106-0111
ISSUE 02

-001		NF-105F
PART NO.	NEXT ASSEMBLY	MODEL
	FIRST USED ON	

3 2 1


CHANGE 4 AMP SLO-BLO TO 2 AMP SLO-BLO WHEN OPERATING AT THE 230 LINE VOLTAGE POSITION
F101 4A SB
S101
OFF
S102
TO T101-13
TO T101-14
150V
FL101
AC LINE INPUT FILTER
INPUT 105/110 VAC 50-400 CPS
115 V POWER CABLE
T101
450 VAC 30 MA
CR101 CR110 CR111 CR112
C101 1 UF 1000V
R102 1.5 10W
V106 0A2
V107 0A2
220 VAC 150 MA
CR102 CR103 CR104 CR105 CR106 CR107 CR108 CR109
C104A C104B 35 400V
235 VAC 35 MA
R101 1.2K
R103 27K 2W
R104 27 1W
R105 27K 2W
R106 39K 2W
R107 68K
R108 47K 1W
R109 100K
R110 30K 5W
R111 15K 5W
R112 25K 2W
R113 30K 5W
R114 27K 2W
R115 100K
R116 47K 1W
R117 1.2K
R118 27K 1W
R119 1.2K
R120 47K 1W
R121 30K 5W
R122 25K 2W
R123 30K 5W
R124 5.1K
R125 0.5 2W
R126 680
R127 0.5 2W
R128 75 5W
R129 470
R130 10
R131 50 2W
C101 .05
C102 .05
C103 .05
C105 .05
C106 35 400V
C107 6400 15V
V101 6AQ5
V102 6AU5
V103 6AQ5
V104 6AU5
V105 6AS7
V108 6AS7
Q101 2N3417
Q102 2N3417
Q103 2N3417
Q104 2N3417
Q105 2N3054
Q106 2N3055
CR110 1N748
6.3 VAC 3.5A
6.0 VAC 10 AMP
11.5 VAC 1.5 AMP
11.5 VAC 1.5 AMP
6.3 VAC 10 AMP
CW ① IMPULSE GEN LEVEL SET
CW ② +150V ADJ
CW ③ -150V ADJ
CW ④ +6.3 VDC ADJ
T101-1
T101-6

		002		RELEASED
		001	[illegible]	[illegible]
		000	[illegible]	[illegible]

+450V

+150VDC

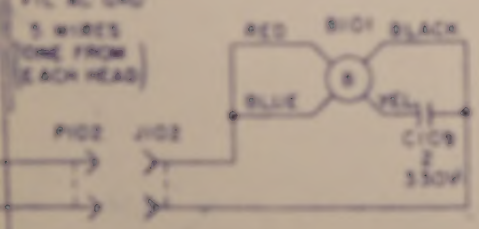
NOTES:
(UNLESS OTHERWISE SPECIFIED)
1. RESISTOR VALUES ARE IN OHMS ±10% ½W/2W.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. FAN (B101) REMAINS CONNECTED TO TERMINALS 1 & 2 OF T101 FOR 230V OPERATION.

-150VDC

6.3 VAC

FIL AC RTN

5 WIRES (ONE FROM EACH HEAD)



+6.0 VDC

FIL DC RTN

5 WIRES

(ONE FROM EACH HEAD)

LAST REF. DESIGNATIONS USED:
R155 C109

SCHEMATIC DIAGRAM
POWER SUPPLY
MODEL RF-1055

D 106-0116